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ABSTRACT

This is one form of three performance checks booklets (A, B, and C) for Level I of the Intermediate Science Curriculum Study (ISCS). The three booklets are considered one of four major subdivisions of a set of individualized evaluation materials for Level I of the ISCS. This booklet (form C), developed to assess the students' achievement of the objectives of Level I, contains a set of performance checks equivalent to the performance checks of the other two forms (A and B). Each performance check has its own code number which indicates the unit number and determines whether it is based on core material or excursions. Directions for students' use of performance checks are also included. (HM)

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INTERMEDIATE SCIENCE CURRICULUM STUDY

ISCS

ED178270

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INDIVIDUALIZED TESTING SYSTEM

Performance Checks

ISCS LEVEL I
FORM C

SE 028 463

SILVER BURDETT
GENERAL LEARNING CORPORATION
Morristown, New Jersey · Park Ridge, Ill. · Palo Alto · Dallas · Atlanta

INDIVIDUALIZED TESTING SYSTEM

ALL LEVELS	**Individualizing Objective Testing** (an ITP module) **Evaluating and Reporting Progress** (an ITP module)
LEVEL I	**Performance Objectives,** ISCS Level I **Performance Checks,** ISCS Level I, Forms A, B, and C **Performance Assessment Resources,** ISCS Level I, Parts 1 and 2
LEVEL II	**Performance Objectives,** ISCS Level II **Performance Checks,** ISCS Level II, Forms A, B, and C **Performance Assessment Resources,** ISCS Level II, Parts 1 and 2
LEVEL III	**Performance Objectives,** ISCS Level III **Performance Checks,** ISCS Level III, ES-WB, Forms A, B, and C WYY-IV, Forms A, B, and C IO-WU, Forms A, B, and C WW-CP, Forms A, B, and C **Performance Assessment Resources,** ISCS Level III, ES-WB WYY-IV IO-WU WW-CP

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FOREWORD

To implement an educational approach successfully, one must match the philosophy of evaluation with that of instruction. This is particularly true when individualization is the key element in the educational approach. Yet, as important as it is to achieve this match, the task is by no means simple for the teacher. In fact, without specific resource materials to help him, he is apt to find the task overwhelming. For this reason, ISCS has developed a set of individualized evaluation materials as part of its Individualized Teacher Preparation (ITP) program. These materials are designed to assist teachers in their transition to individualized instruction and to help them tailor their assessment of students' progress to the needs of all their students.

The two modules concerned with evaluation, *Individualizing Objective Testing* and *Evaluating and Reporting Progress,* can be used by small groups of teachers in in-service settings or by individual teachers in a local school environment. Hopefully, they will do more than give each teacher an overview of individualized evaluation. These ITP modules suggest key strategies for achieving both subjective and objective evaluation of each student's progress. And to make it easier for teachers to put such strategies into practice, ISCS has produced the associated booklets entitled *Performance Objectives, Performance Assessment Resources,* and *Performance Checks.* Using these materials, the teacher can objectively assess the student's mastery of the processes, skills, and subject matter of the ISCS program. And the teacher can obtain, at the moment when they are needed, specific suggestions for remedying the student's identified deficiencies.

If you are an ISCS teacher, selective use of these materials will guide you in developing an individualized evaluation program best suited to your own settings and thus further enhance the individualized character of your ISCS program.

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NOTES TO THE STUDENT

Now that you have completed several chapters, excursions, and self-evaluations, you are ready to help your teacher determine how well you are doing. The performance checks in this book will provide your teacher with this information. Then your teacher can help you with things you may not understand and can keep a record of your progress.

Read the next section carefully. It explains some important things about the performance checks in this book, and it gives you specific suggestions for using them.

What You Need to Know about Performance Checks

1. **You do performance checks when you are ready.** Performance checks are somewhat like the questions in the self-evaluations – you do them when you are ready, not when the whole class is ready.
2. **Your teacher or both of you decide how many you do.** Your teacher or you and your teacher together will decide which ones you should do. You are not expected to do all of the performance checks.
3. **There are three forms for each performance check.** Every performance check is written in three forms – A, B, and C. (The title of this booklet tells you whether it is Form A, B, or C.) Usually the answers for each form are different. When you do a check, you will use only one form. The A, B, and C forms are always in different booklets. Within each booklet all the performance objectives for the same unit are listed together. These units are in numerical order. Each unit has performance checks based on core material and performance checks based on excursions.
4. **Each performance check has its own number.** The number is in the outside margin of the page and will look like this: 03-Core-17A or 05-Exc 17-2A. These numbers mean

03	-	Core	-	17	A	and	05	-	Exc	17	-	2	A
unit		based on core material		check number	form of the check		unit		based on the excursion material	excursion number		check number	form of the check

5. **Each performance check is separated from the other.** There is a line before each performance check and one after it. Some performance checks have several parts, so do everything called for between the lines. When there is no line at the bottom of a page, you can expect to find the check continued onto the next page.

6. **Sometimes you will need to use equipment.** If special materials are needed, they will be in boxes labeled with the same number and sometimes the same letter too as the performance check for which you need them.

7. **Some performance checks have two or more answers.** If more than one answer is correct, you must select all the correct choices. In such cases selecting just one answer is not enough.

8. **Some performance checks have no answers.** Occasionally, you may be asked to do something that is impossible and to explain your answer. If so, say that the task is impossible and explain why.

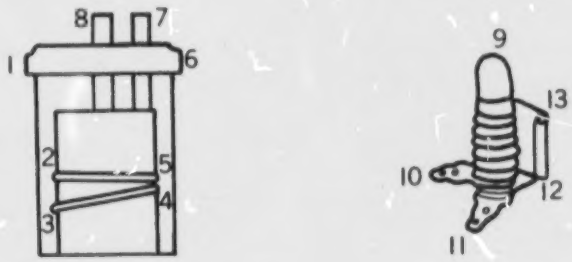
9. **You share books of performance checks and YOU DO NOT WRITE IN THEM.** Write your answers on other paper. Give the number and form of the performance check for each answer you write. If you are to draw a graph, your teacher may provide you with grid paper.

10. **Your teacher or his assistant will collect and mark your checks.** And sometimes you must ask him to watch or assist you as you do a check.

11. **Sometimes a review procedure will be suggested.** If you can't do a performance check, you may be asked to review a part of the text or a self-evaluation question. You may then be checked on the same material, so be sure you understand the material you review. Get help if you need it.

Get two test leads, a bulb, a socket, and an ISCS battery from your teacher. Charge the battery for one minute. Get your teacher to watch you. Now connect the bulb to the battery so that the bulb lights. **01-Core-1C**

Look at the drawing below to see where you would put test leads to make the bulb light. Then, write the two numbers for each test lead that show where the ends of each lead should be connected. **01-Core-2C**



Something that changes in an activity and affects the results of the activity is called **01-Core-3C**

a. a solution.
b. an example.
c. a variable.
d. a data table.

In box 01-Core-4C you will find a circuit that is all set up. Use the good spare parts in the box to find out why the bulb doesn't light. Which part is bad? **01-Core-4C**

Get batteries C, E, and F from box 01-Core-5. Use any other materials you think you need. Which of the batteries has influence? **01-Core-5C**

A nutcracker can transfer influence to the shell of a walnut. Why must you squeeze the nutcracker before it can break the shell of the nut? **01-Core-6C**

Match the following terms by first listing the numbers (1, 2, and 3) on your paper and then writing after each number the letter (a, b, c, or d) of the correct matching definition. **01-Core-7C**

Terms	Definitions
1. Subsystem	a. A group of objects that interact with each other
2. Component	b. Any object that is part of a system
3. System	c. A group of objects that directly interact with each other within a system
	d. An object that does not interact with other objects

01-Core-8C On your paper, write the letter of each diagram which identifies a system. Also explain why the diagram or diagrams you chose represent systems.

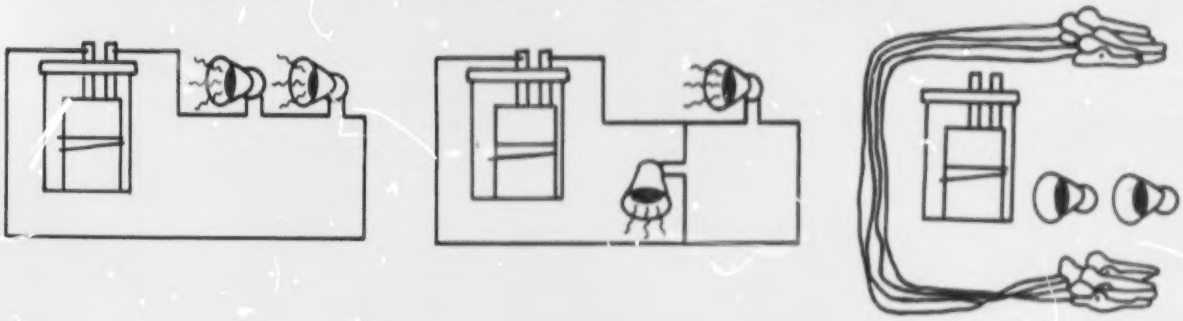


Diagram a Diagram b Diagram c

01-Core-9C

On the diagram above, measure the distance between the following points to the nearest 0.1 cm.

1. What is the distance from point C to point A?
2. What is the distance from point B to point D?
3. What is the distance from point F to point E?

01-Core-10C Ask your teacher or his assistant to move a pencil back and forth for you. You tell him when to start. Use your ISCS timer to find out how long the pencil moves.

01-Core-11C On your paper write the letters of all good reasons for using data tables.

a. Data tables store information in a useful way.
b. Data tables remind you to collect the same data in each trial.
c. Data tables make it easier to find how one variable affects another.
d. Data tables help make sure you collect the same data for each set of measurements.
e. All of these.

01-Core-12C

Name of Group Member	No. of Sinkers Dragged	No. of Times Dragged	Distance from Hook to Pulley (cm)	Total Distance Dragged (cm)	Total Time for Dragging (sec)
Sue	1	70	90	6300	130
Betty	2	60	85	5100	110
Sam	3	50	80	4000	105

Study the table. Then answer all the questions below.

1. What was the distance in centimeters from hook to pulley when one sinker was dragged?
2. What was the total distance in centimeters that three sinkers were dragged?
3. How many times were the two sinkers dragged?

Which phrase below correctly completes the sentence? An operational definition includes a description of ____ the thing being defined. 01-Core-13C

a. the color or beauty of
b. the way to measure
c. the texture or luster of
d. the way to classify

On your paper, divide 14.38 by 3.4. Round off your answer to one number after the decimal place. 01-Core-14C

On your paper, multiply 3.22 by 4.4. 01-Core-15C

Add these three numbers on your paper. 3.5, 4.28, 6.71 01-Core-16C

Subtract 5.75 from 8.7 on your paper. 01-Core-17C

Your teacher will observe you for this check when he can. 01-Core-18C

Your teacher will observe you for this check when he can. 01-Core-19C

Your teacher will observe you for this check when he can. 01-Core-20C

Your teacher will observe you for this check when he can. 01-Core-21C

Your teacher will observe you for this check when he can. 01-Core-22C

01-Exc 01-1C

Which of the following tells the main advantage of the metric system which makes it useful in measurement problems?

a. The units of the metric system are related by factors of the numberten, and therefore changing from one unit to another is easier.
b. The meter has a more reasonable historical basis than the yard.
c. It was developed in France, and most of the early scientists were French.
d. The metric system is more exact than the English system.

01-Exc 01-2C

The measurement system that is used in ISCS science is the

a. Metric system.
b. Greek system.
c. Hebrew system.
d. English system.

01-Exc 03-1C

In Excursion 3, you studied two forces – lift and drag – acting on two sinkers. One force was greater than the other. You found this by making the two forces act directly on each other. Read the two examples below. Which one makes a direct comparison of the two variables?

a. Carla and Joan sat on opposite ends of a seesaw to find out who was heavier? Which girl was heavier?
b. Carla was heavier than Roberta on the seesaw at school. Roberta was heavier than Carla on the seesaw in the park. Which girl was heavier?

Which of the following is an operational definition? **02-Core-1C**

a. A slug is a unit of mass in the English system. It is defined in terms of acceleration and force.

b. Sound is the form of energy which causes the needle of a sound level meter to move. The amount of needle movement measures the loudness of the sound.

c. Biology is a science that deals with living things.

Each student in your class marked his scale for his force measurer in washer units. **02-Core-2C**

1. If each student used his own washer unit scale for the rest of the course, would the scale cause a problem?
2. Explain your answer.

Suppose your teacher handed you a postage stamp and asked you to weigh it with your force measurer. List the letters of all of the things below that you would need for your force measurer. **02-Core-3C**

a. A very thin blade

b. A longer scale card

c. The thin blade and the 0 to 10 N card

d. A scale calibrated in units from 0 N to 0.1 N

Get an ISCS force measurer, 2 blades, paper clips, and a newton scale card from the supply area. From your teacher, get an electricity measurer base and a skate wheel. Report to your teacher how much the electricity measurer base weighs and how much the skate wheel weighs. **02-Core-4C**

Get box 02-Core-5C from the supply area. Use an ISCS force measurer, a newton scale card, an aluminum cup, and paper clips to weigh each of the two objects. On your paper, write the difference in newtons between the weights. **02-Core-5C**

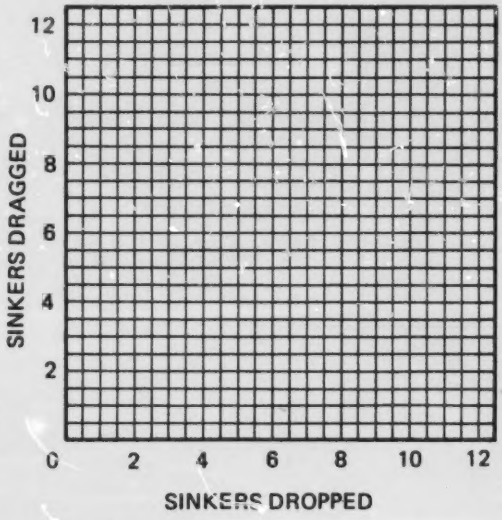
Nancy brought some marbles to school to weigh on her force measurer. She added them one at a time to a cup hung from the end of the force measurer. Her data are shown in the table below. **02-Core-6C**

Number of Marbles	Weight of Marbles (in newtons)
1	0.7
2	1.4
3	1.8
4	2.5
5	3.2
6	3.6

What do you conclude about the weights of the marbles Nancy brought to school?

02-Core-7C Susan did Excursion 3, which compares weight and drag. On a separate piece of graph paper, label the axes as shown below. Construct a graph of Susan's data, listed in the table below. The table shows the dragging power of the dropping sinkers. Draw a best-fit line for the plotted points.

Sinkers Dropped	Sinkers Dragged
2	4
3	6
4	8
5	10



02-Core-8C Write an operational definition for *weight*, using an ISCS force measurer in your definition.

02-Core-9C Ask your teacher for a force measurer with an aluminum pin in it. Do not remove the pin.

Answer the following questions by listing the numbers (1, 2, and 3) on your paper and writing after each number the answer to the corresponding question.

1. Does the force measurer have the thin or thick blade attached to it?
2. What is the number of the hole the pin is in?
3. How much force is on the aluminum pin?

02-Core-10C From your teacher, get force measurer scale card 02-Core-10C. Use your force measurer with the thin blade to weigh a sinker. Have your teacher watch you. Report the weight in the units shown on the scale card.

02-Core-11C On your paper, write the word which completes the following sentence. The metric unit used in ISCS to measure force is the___.

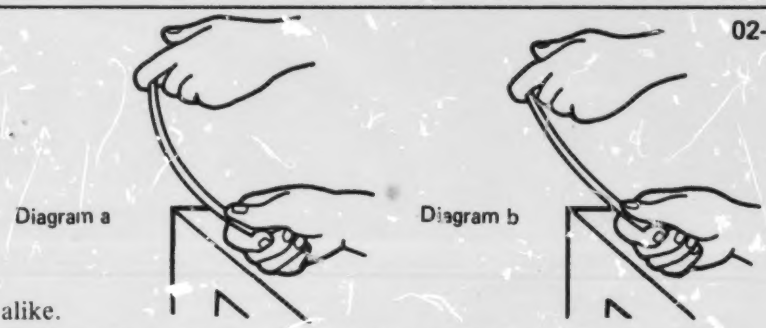
02-Core-12C On your paper, write the words that complete the sentence below.

You can tell that a force is acting on a basketball if you can see changes in its ___ or ___.

Get a compass and the heavy blade of a force measurer from the supply area. Set the compass on your desk. Bring the heavy blade very near to the compass from three different directions. Watch what happens. **02-Core-13C**

1. Is there a force acting between the heavy blade of the force measurer and the compass?
2. How do you know?

02-Core-14C



The two rulers being bent are alike.

1. Which diagram shows the greater amount of force being applied?
2. Why did you make that choice?

An operational definition answers two questions. Think what the questions are and then answer them as you write an operational definition for *force*. **02-Core-15C**

An operational definition answers two questions about something. Write those two questions on your paper. **02-Core-16C**

When a ½ kilogram mass is hung on a force measurer blade, the force measurer blade bends. Name the kind of force pulling down on the blade. **02-Core-17C**

A squirrel carefully climbs out on a twig. The twig bends and snaps off. What force causes the change in the shape of the twig? **02-Core-18C**

Terms such as *beauty* and *honor* are difficult to define operationally. List two reasons for the difficulty. **02-Core-19C**

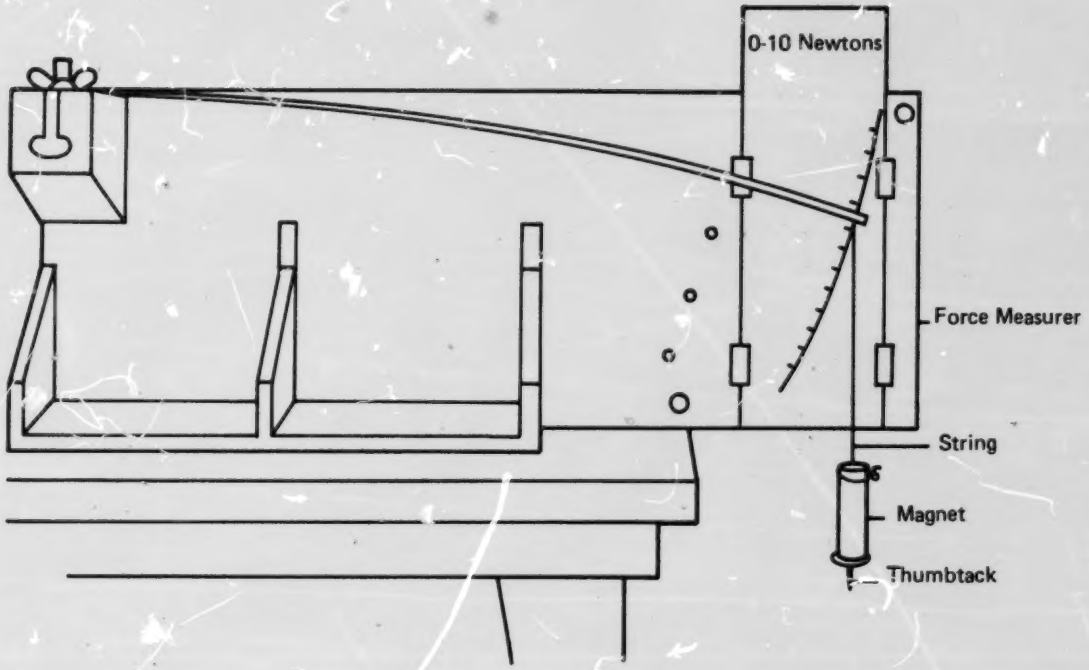
Look at the diagrams of the measuring instruments. What needs to be added to them so that you could tell your teacher your measurement without having to show him the thermometer or the speedometer? **02-Core-20C**

Speedometer

Thermometer

02-Core-21C Tie or tape a string to a magnet as shown below. Hang the magnet on a thick force measurer blade. Measure the combined weight of the magnet and string. Number and record your results for each step of the following.

1. Record the combined weight of the magnet and string.
2. Attach a thumbtack to the magnet as shown. Pull gently on the thumbtack until the magnet releases it. What is the force measurer reading when the magnet releases it?
3. How much force did the magnet exert on the thumbtack?



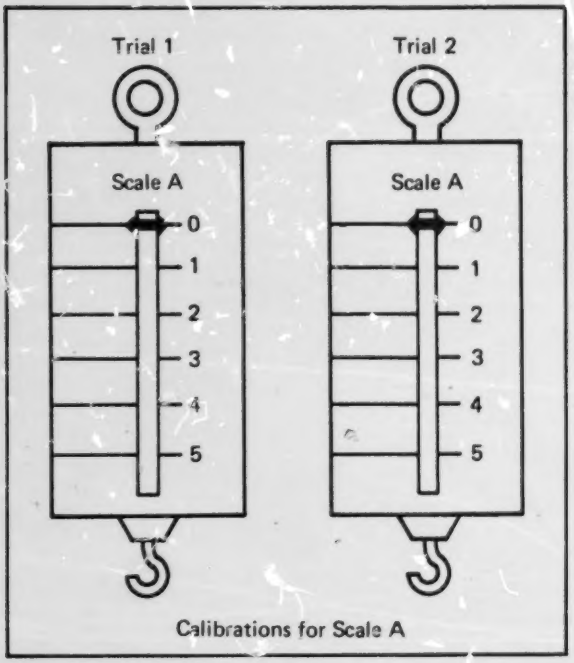
02-Core-22C List the letters of the situations described below in which there is a force acting in addition to gravity and friction.

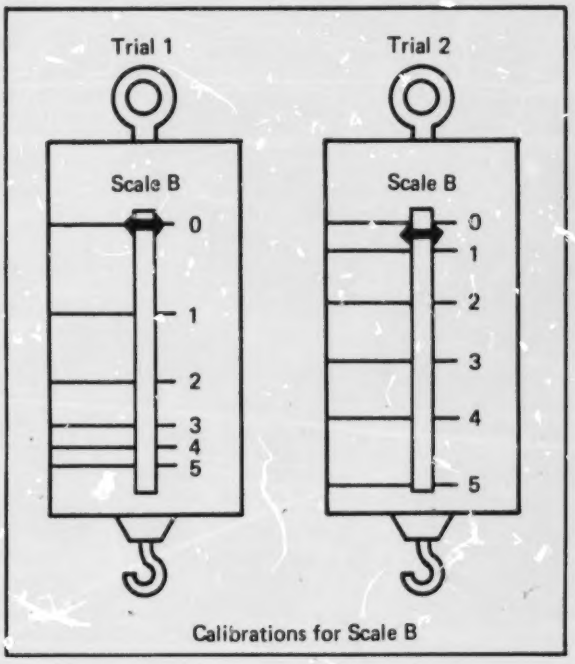
a. A trailer parked in a garage
b. A baseball smashing through a window
c. Two science students hitting head-on
d. A pulley sitting on a shelf
e. A lead strip lifted from a desk

02-Core-23C What four things should be true about something that is to be used as a standard unit of measurement?

Roberta was given two old and uncalibrated spring scales, A and B. She calibrated each spring scale two times. The two drawings below show the results of her calibrations of each scale. Roberta must use one of these two scales in an experiment. **02-Core-24C**

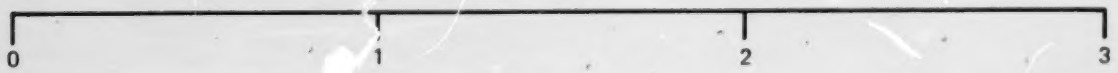
1. Which spring scale should she use?
2. Why?





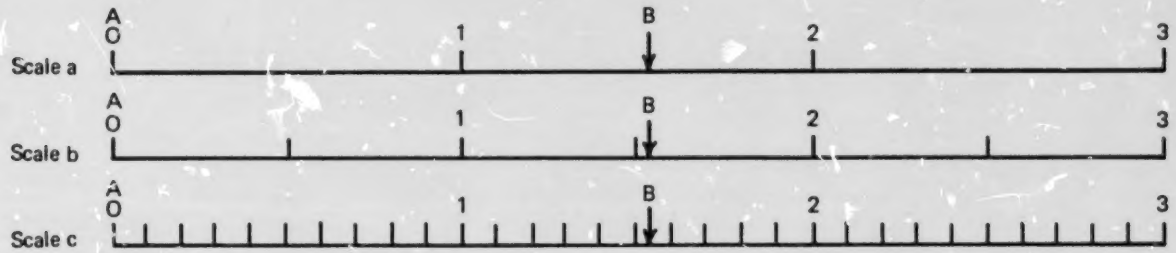
In this course, you often make several measurements which you are then asked to multiply and divide. Suppose you were to use the scale below. **02-Exc 06-1C**

1. Would it be easiest to report, multiply, and divide the measurements if the units on the scale were divided into 9, into 10, or into 11 subunits?
2. Why?

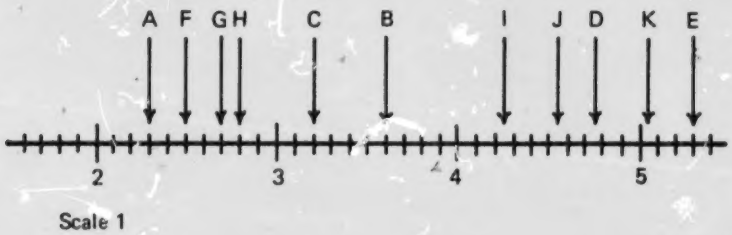


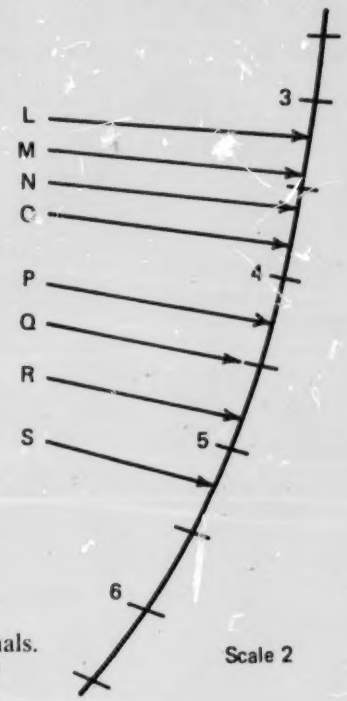
02-Exc 06-2C

1. Which of the scales below would allow you to make the most accurate measurement from A to B?
2. Why?



02-Exc 06-3C





Report your answers to both questions below in decimals.

1. On scale 1, what is the reading at H? At K?
2. On scale 2, what is the reading at N? At P?

02-Exc 07-1C

Write the letter of the best answer. When the size of a unit of measurement such as the meter was first determined, it was

a. always fixed by nature.
b. taken from a list of standards passed down through the years.
c. set by a group of men who agreed on its size.
d. discovered by scientists.

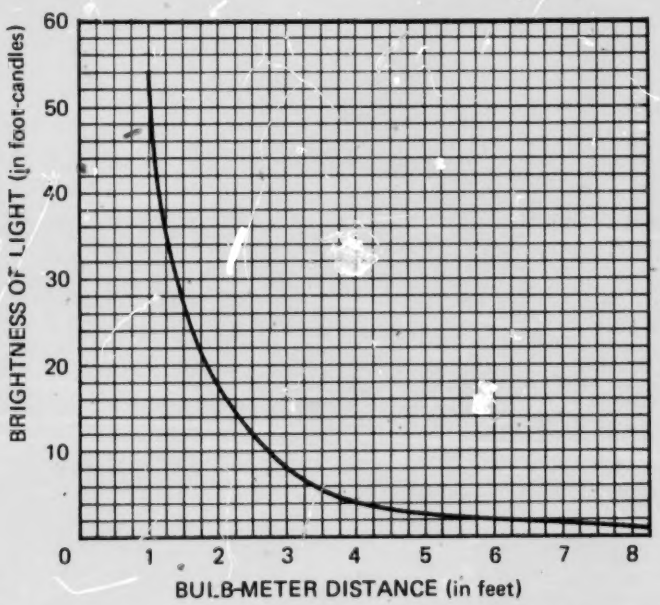
The *palm* is a unit of length based on the width of a man's hand. The *cubit* is a unit of length based on the distance from a man's wrist to his elbow. **02-Exc 07-2C**

1. Why are measuring units such as the palm and cubit not used much today?
2. Why are standard units such as the gram and meter used instead?

The brightness of a lighted bulb was measured with a light meter at several distances from the bulb. The data are graphed as shown below. Notice that the light brightness decreases as the distance increases. **02-Exc 08-1C**

Compare the change in brightness between the distances 1 foot and 2 feet with the change between 4 feet and 8 feet. Choose the words which correctly complete the following two sentences.

1. When the bulb and meter are close together, a small change in distance produces a (large)(small) change in brightness.
2. When the meter and bulb are far apart, a large change in distance produces a (large)(small) change in brightness.

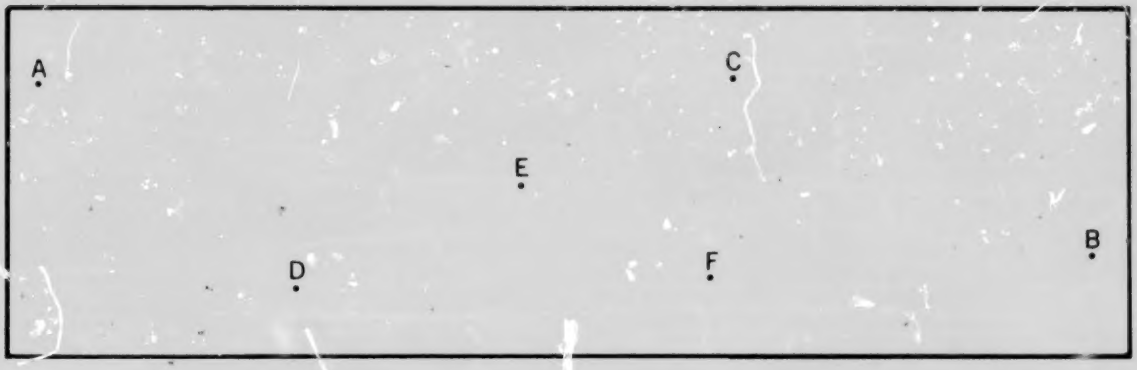


How can Iggy lift a box from the floor to a desk with the least amount of work being done on the box? Select the best answer below. **03-Core-1C**

a. Lift it with his hands.
b. It doesn't matter how he does it. The work on the box is the same.
c. Use a pulley and a rope.
d. Push it up an inclined plane.

Measure the distance between each of the three pairs of points, and report your answers in meters. **03-Core-2C**

1. A to D
2. D to F
3. B to F



In each of the following cases, make the changes asked for. **03-Core-3C**

1. 2.9 m = ___cm
2. 72 cm = ___m
3. 8 cm = ___m
4. 4.1 m = ___cm

The name of the metric unit used in ISCS for measuring work is ____. **03-Core-4C**

Find out how much work is done when you lift an ISCS cart from the floor to your desk top. Get the equipment you need to do this. Record your measurements in newtons and meters, and record the answer in the correct units. **03-Core-5C**

State an operational definition for *work*. **03-Core-6C**

Complete the sentence below. **03-Core-7C**

Monica lifted a test tube from the floor and set it on the table. Her ISCS classmates said she was doing ____ on the test tube.

03-Core-8C

A force measurer was used to pull Nancy's purse across the floor. What measurements below would you use to measure the work done on the purse? Choose as many as you need. Do not calculate the work done.

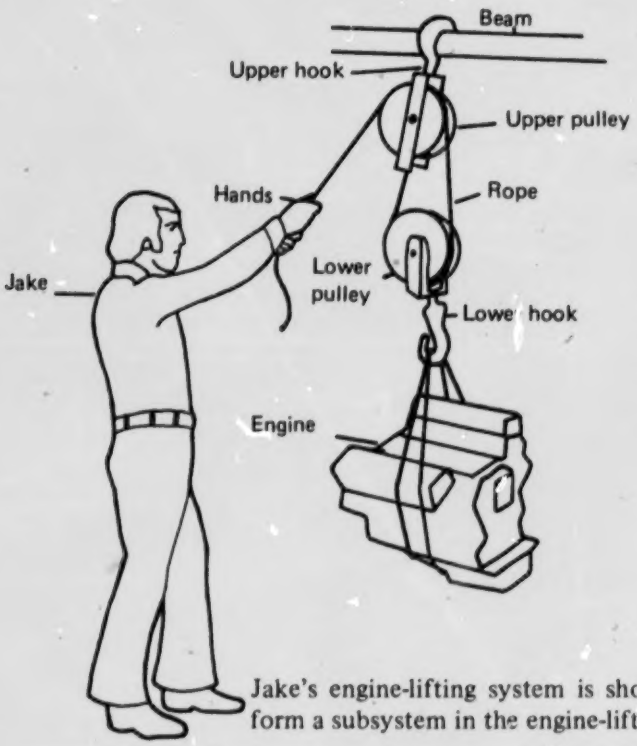
a. The force measurer showed 3 newtons of force.
b. The purse moved 270 cm.
c. The speed it moved was 3 cm per second.
d. The purse moved for 90 seconds.

03-Core-9C

Match the terms *system*, *subsystem*, and *component* with their definitions. Write the number of the term and the letter of the matching definition on your answer sheet.

Terms	Definitions
1. System	a. A group of objects, such as a hat, a book, a feather, and a clod of dirt
2. Subsystem	b. A person who fights another
3. Component (of a system)	c. A group of objects that interact directly within a system
	d. A group of objects that interact with each other
	e. An object that is part of a system

03-Core-10C



Jake's engine-lifting system is shown above. List four labeled components which form a subsystem in the engine-lifting system.

Study the diagrams below. **03-Core-11C**

1. List the letter of each diagram which shows a single system.
2. Explain why any diagrams you chose represent systems.

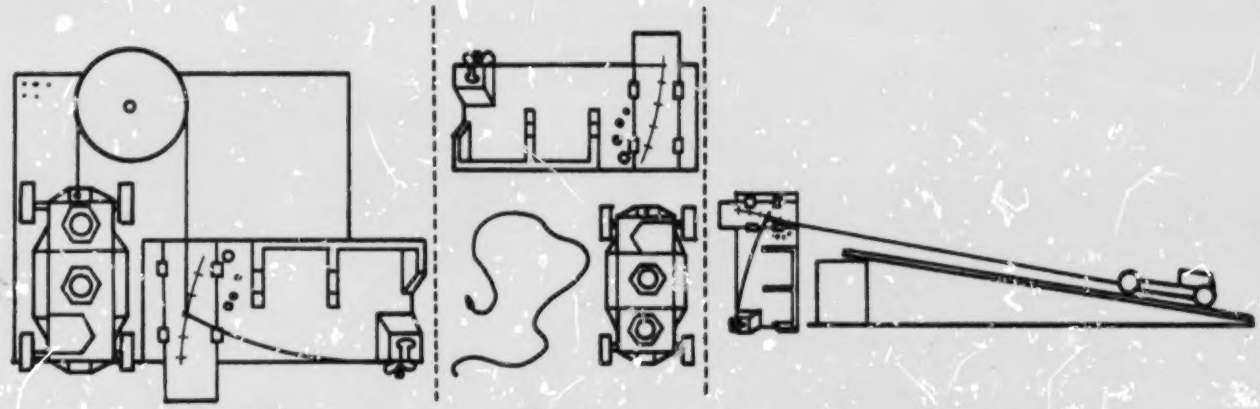
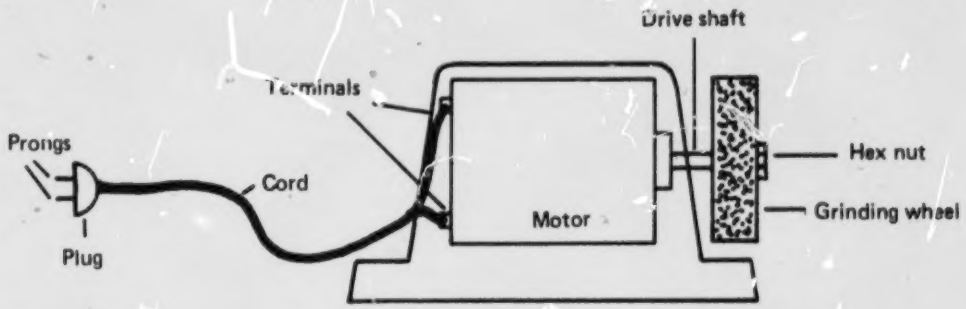


Diagram a Diagram b Diagram c

Study the diagram of the grinder. **03-Core-12C**

1. List each of the sets of components listed below which can be considered a subsystem.
2. Why did you select those sets?



Components

a. plug, motor, grinding wheel
b. cord, motor, drive shaft
c. grinding wheel, terminal, prongs
d. plug, prongs, motor
e. grinding wheel, drive shaft, motor

Select the phrases which describe the relationship between work and systems. Systems can **03-Core-13C**

a. have equal input work.
b. have equal input work and output work.
c. operate with no input work.
d. use input work to do useful work.

03-Core-14C

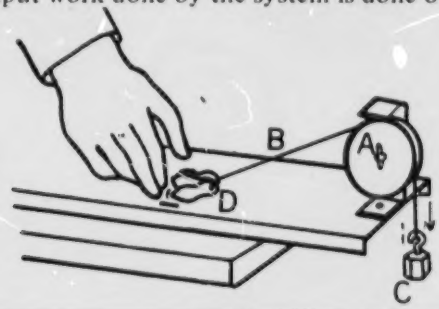
Look at the diagram below. A mason (D) wants to lift a sack of cement (A). To move the cement, he puts a board (C) over a rock (B) and places one end of the board under the cement. He then pushes down on the other end of the board and lifts the cement.

1. Name the letter of the input component.
2. Name the letter of the output component.

03-Core-15C

In the diagram, consider the ½ kg mass (C), the string (B), the pulley (A), and the sinkers (D) to be a system. After the appropriate numbers, write the letter that identifies the source of the input work in the system and the letter that identifies the object on which the output work is done.

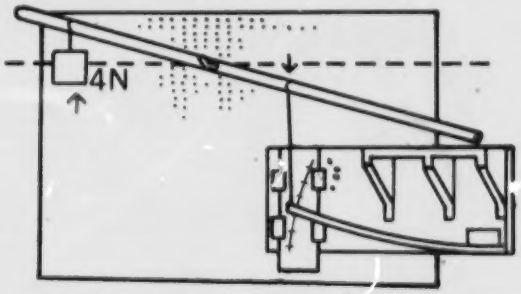
1. The input work is done in the system by ____.
2. The output work done by the system is done on ____.



03-Core-16C

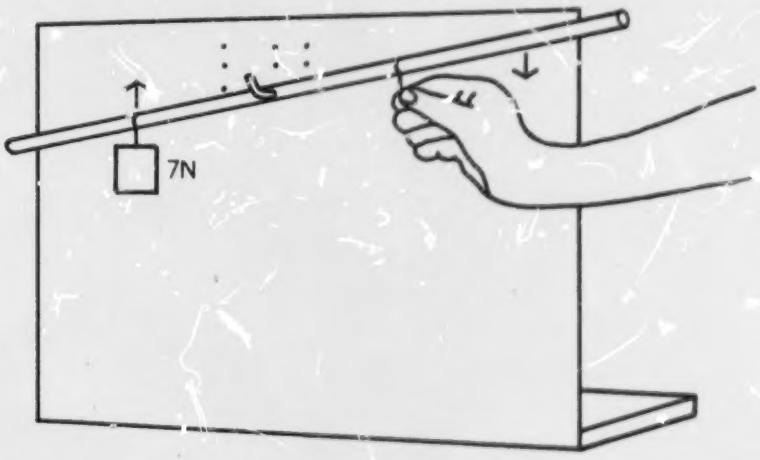
In the diagram below, think of the balance arm as a system. The force measurer shows a reading of 6 N and moved down 0.18 m. The 4 N weight moved up 0.23 m.

1. How much input work was done on the system?
2. How much output work was done by the system?



Delia checked the equal-arm balance system shown below. In doing that, she lifted the 7 N weight 0.3 meter. Her partner Kitty asked her how much input work she had put into the system. What is the best answer Delia could have given? **03-Core-17C**

a. Just a little bit more than 2.1 N·m
b. Just a little less that 2.1 N·m
c. Exactly 2.1 N·m
d. It is impossible to say, since no force or distance measurements were made of the work input



Find the average of each of the following two sets of numbers. Show your work. **03-Core-18C**

1. 2.1, 2.3, and 1.7
2. 2.2, 1.8, and 2.4

Alice counted the number of drops per minute from a leaky faucet. Her data from several trials are recorded in the table below. Why is the average of 37 drops per minute probably closer to the true drop rate than any single measurement? **03-Core-19C**

Trial	Drops per Minute
1	40
2	34
3	36
4	38
5	39
6	35
Average	37

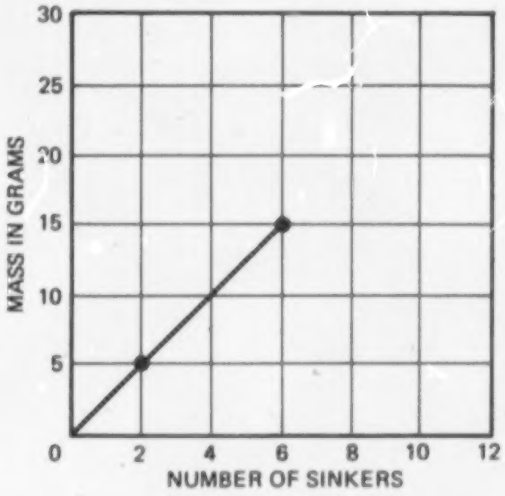
03-Core-20C Four students determined the weight of a lead strip that they were testing. Each student weighed the strip two times. They got the following data.

Student	Trial 1 (in N)	Trial 2 (in N)
Ann	0.201	0.196
Art	0.198	0.200
Dick	0.199	0.202
Bill	0.197	0.196

Why shouldn't the students all expect to get the same weight for the strip?

03-Core-21C Get from your teacher either a copy of the graph below or grid paper. (On grid paper, copy the graph below, label the axes, plot the points, and draw the line.) Using the graph, find the mass in grams of the following.

1. 7 sinkers
2. 3 sinkers
3. 9 sinkers
4. 1 sinker



03-Core-22C Marvin attached his force measurer to a box of thumbtacks and pulled the box across his desk. The force measurer reading as the box moved along was 0.15 newtons. What is the name of the force he was measuring?

03-Core-23C John found that the input work on his machines always had to be greater than the output work he expected. Why is this true?

When you crease a newspaper by rubbing your finger along the fold, your finger gets hot. What force causes your finger to get hot? **03-Core-24C**

Think of an empty wooden soft drink case being dragged along a grocery store floor. What would happen to the amount of friction if the case were filled with twenty-four bottles? **03-Core-25C**

Mr. Black wanted to determine which model engine was better for a certain type of track. He also wanted to determine which fuel was the better fuel. He put fuel A in engine 1 and fuel B in engine 2 and tested them. What is wrong with Mr. Black's experiment? **03-Core-26C**

Jean was studying heartbeat rate. She had Jim run for three minutes and Sally walk for three minutes on the school track. She then tested their heartbeats for one minute. **03-Core-27C**

1. Name a variable that is unchanged in both cases.
2. Name a variable that changes in the two cases.

A paint manufacturer wants to know which of four paints will fade the least from the effects of weather. **03-Core-28C**

1. What variable should be purposely varied in the experiment?
2. After the manufacturer has made the changes proposed in part 1, what variable does he study the changes in?

A racing car owner wants to know which of three drivers has the driving ability to go around the track in the fastest time. Naturally each driver will drive around the same track. Name two other factors which the owner should keep unchanged if his trials are to be useful. **03-Core-29C**

In the pulley arrangement shown in the diagram below, the mass and the pulley together weigh 80 N and will be lifted 40 cm. Read the sentences which follow. Select the one quantity in parentheses which best completes each sentence, and record your answers. **03-Exc 9-1C**

1. To raise the mass and pulley 40 cm, the force would have to move (20, 40, 80) cm.
2. The amount of force required to raise the combined weight of 80 N of the mass and the pulley by pulling on the rope would be about (40, 80, 160) newtons.

03-Exc 10-1C

In Excursion 10, you investigated the effect of using more than one pulley in a system. You compared input work with output work in each case.

1. What is the comparison between the input work and the output work of movable pulley systems?
2. What is the advantage of using movable pulleys to lift objects?

03-Exc 11-1C

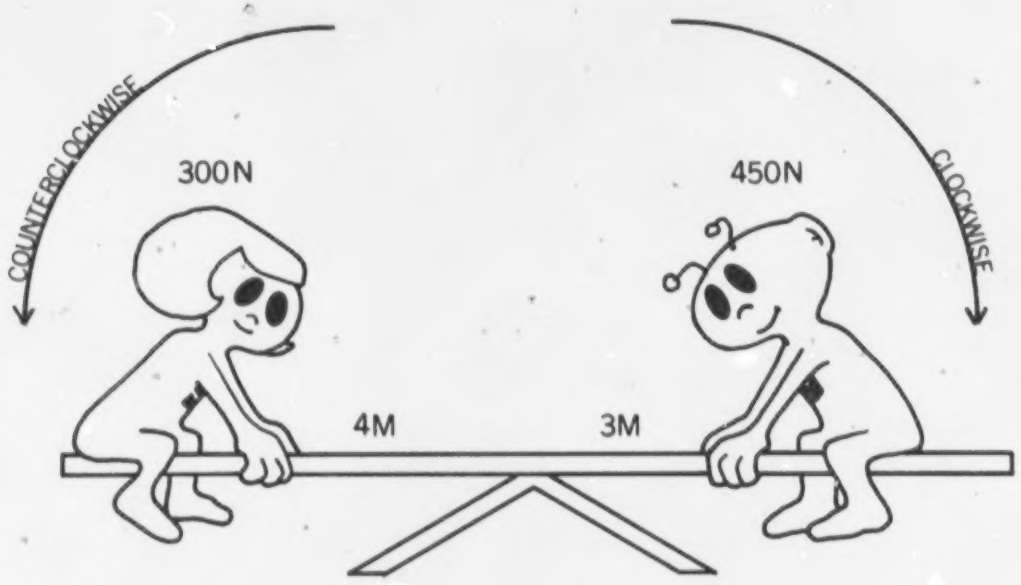
Two men couldn't lift a piece of machinery into the back of a delivery truck. They got a ten-foot ramp and tried to slide the machine up it, but they still couldn't do it.

1. If the men replaced the ramp with a strong twenty-foot ramp, would the force required to push the machinery into the truck be decreased, increased, or not changed?
2. Explain why this is the case when a longer ramp is used.

03-Exc 12-1C

Mrs. Brown holds a seesaw while Louis, who weighs 450 N, climbs on the right end 3 meters from the pivot. After his sister Janis, who weighs 300 N, gets on the other end at 4 meters, Mrs. Brown lets go.

1. Will the greater moment then cause the seesaw to turn clockwise or counterclockwise?
2. What is the amount of difference in the moments?



03-Exc 13-1C

Find the average to one decimal place for each set of numbers. Show your work.

1. 5¼, 6½, 4¾
2. 7¼, 6¾, 7½

The wood block shown is dragged three times over a table. Each time a different surface, A, B, or C, is on the table. Which statement below best describes the result? **03-Exc 14-1C**

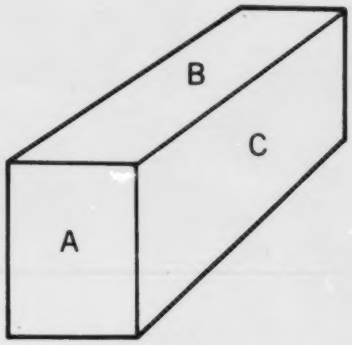
The force of friction

a. will be the greatest on surface C because it has the largest area.

b. will be the same on all surfaces because the total weight acting on each surface is the same.

c. will be the greatest on surface A because there is more weight on it, and weight increases friction.

d. will be the smallest on surface C because there is less weight per square inch on it.



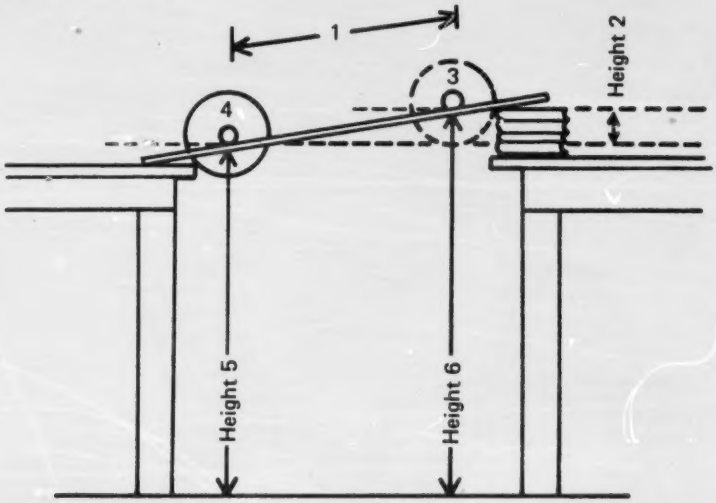
Imagine that a spring is squeezed or the bowstring of a bow is pulled back. What kind of energy is given to the spring or the bow string? Select the best answer below. **04-Core-1C**

a. motion energy
b. heat energy
c. frictional energy
d. potential energy

A wound-up clockspring, rocket fuel, and a brick on the edge of a shelf have potential energy. What is the meaning of the term *potential energy* as it is used in that sentence? **04-Core-2C**

The spinigig is lifted off the track at 4 and set back onto it at 3. Record the letters of any measurements you would use to calculate the change in the potential energy of the spinigig. **04-Core-3C**

a. Weight of the spinigig track in newtons
b. Weight of the spinigig in newtons
c. Distance up the track at 1 in meters
d. Height 6 in meters
e. Height 2 in meters



A monkey, a baboon, and a chimp are parts of an act in which each in turn jumps onto the upper end of a seesaw. They cause large red balls on the lower end of the seesaw to be tossed high into the air. Calculate the potential energy each supplies to the seesaw. Show your calculations and answers on your paper. **04-Core-4C**

Animal	Weight-Force of Animal (in newtons)	Height above Seesaw (in meters)
1. Monkey	27.0	2.0
2. Chimp	55.6	2.7
3. Baboon	97.3	2.9

04-Core-5C

1. If Mary lifts a boulder off the ground to the top of a wall, does she give it energy?
2. If so, what kind of energy does she give it? If not, why doesn't she give it energy?

04-Core-6C

Name a metric unit used in ISCS to report the gravitational potential energy of an object.

04-Core-7C

Your instructor has suspended an object, labeled 04-Core-7C, above the floor. Use your force measurer and a meterstick to find its potential energy. Show your measurements and calculations.

04-Core-8C

Look at the diagram below. When the boy kicks the football, it goes down the field.

1. Name the component doing the input work.
2. Name the component receiving the output work.

04-Core-9C

Tell what is meant by *input work.*

04-Core-10C

Select the phrase that completes the sentence. The name given to the object in a system that does work on something else is the

a. input work.
b. energy supplier.
c. output work.
d. energy receiver.

04-Core-11C

Select the phrase that completes the following sentence. The name given to the object in a system that has work done on it by something else is

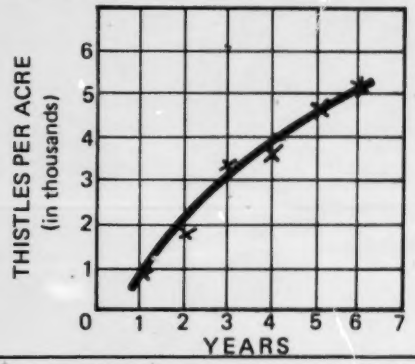
a. input work.
b. energy receiver.
c. output work.
d. energy supplier.

Describe a method for telling whether an object has motion energy. You may use an example if you wish. **04-Core-12C**

Set in the roller bearing blocks, you have a 4-disk spinigig with a string wrapped around its axle. Attached to the string is one sinker that can fall 1 meter and cause the spinigig to spin. What effect would doubling the number of sinkers have on the spinigig's speed of rotation? **04-Core-13C**

Suppose your spinigig turns 10 times in 50 seconds. What is its speed in turns per second? Show your calculations on your paper. **04-Core-14C**

What does the curved line on the graph tell you about the thistle growth on an unplowed farm? (Hint: Compare the change in the thistle growth between the 5th and 6th years with that between the 1st and 2nd years.) **04-Core-15C**

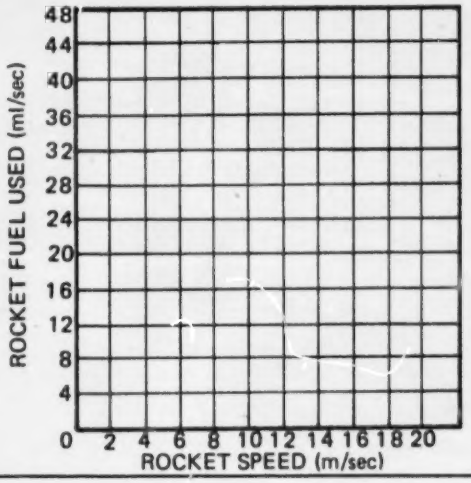


What unit would you use for recording the speed of a spinning object such as a spinigig? **04-Core-16C**

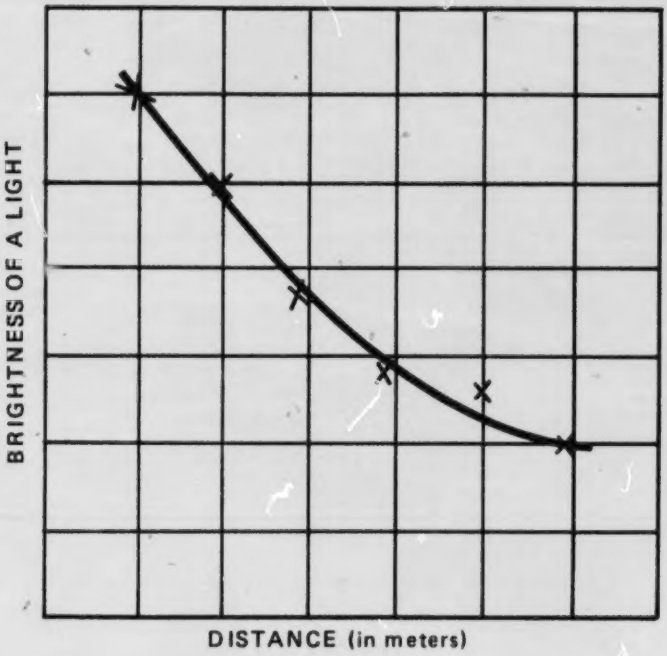
Get some graph paper, draw a pair of axes, and label them as shown below. Use your grid and the table below to plot rocket speed against fuel used. Draw a best-fit line for the plotted points. **04-Core-17C**

Rocket Speed per Ml of Fuel

Speed (m/sec)	Fuel (ml/sec)
2	7
4	12
6	16
8	19
10	20
12	22
14	23
16	24
18	24



04-Core-18C What two things does the best-fit curved line on the grid below tell you about the brightness of the light beam as you get farther away from it?



04-Core-19C A spinigig with 3 disks and a string wrapped around its axle is set into the roller skate wheels and placed on the track. Attached to the string is one sinker that can fall one meter and cause the spinigig to spin. What effect would increasing the number of disks on the spinigig have on its speed of rotation?

04-Core-20C Define *mass.* (Hint: Consider how it is used in the following sentence.) Helen's left shoe had a mass equal to the mass of her right shoe.

04-Core-21C Hazel picked up her purse and put it on the top shelf in the closet. The purse gained potential energy. What kind of energy did Hazel apply to the purse?

04-Core-22C

1. What kind of energy does a bale of cotton have when it is held ten feet above the ground by a rope?
2. If the rope is cut and the bale of cotton falls, its energy changes. What kind of energy is it changed to?
3. What force acts upon the bale of cotton to change the energy after the rope is cut?

Look at the diagram below. A small boy lifts a rock and drops it on a shell to break it. **04-Core-23C**

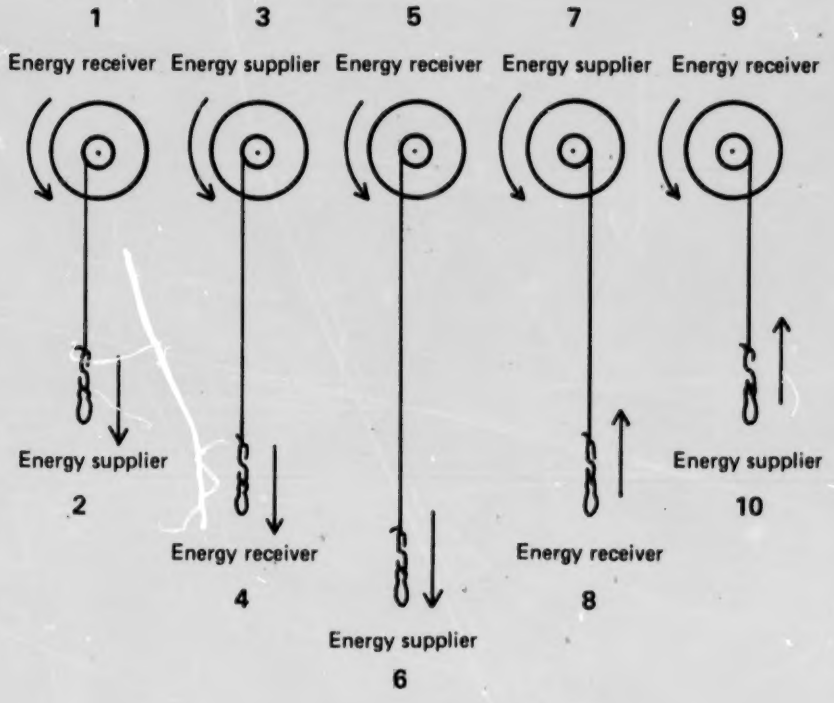
1. Name the supplier of input energy to the system.
2. Name the receiver of output energy from the system.

When a foot moves, it has energy. It can kick a football. How could the energy of the moving foot be measured as it kicks the ball? **04-Core-24C**

The force required to slide a barrel used to block a driveway is 9.6 newtons. A boy on a bicycle struck the barrel and moved it 7 meters. How much motion energy did the boy and bicycle have if it was all given to the barrel? **04-Core-25C**

04-Core-26C

In the diagram below, arrows correctly show the direction in which five spinigigs are moving. However, some of the labels are incorrect. List the number of each of the incorrect labels.



04-Exc 15-1C

Ganymede is a moon of the planet Jupiter. It is larger than the earth's moon. The force of gravity on a 1 kg mass on Ganymede is about 3.44 newtons. On earth, it is about 9.8 newtons.

1. If a cannonball were taken from the earth to Ganymede would its mass change?
2. What would happen to its weight?
3. How did you know what answers to give?

04-Exc 15-2C

A television camera was taken to the moon by the astronauts.

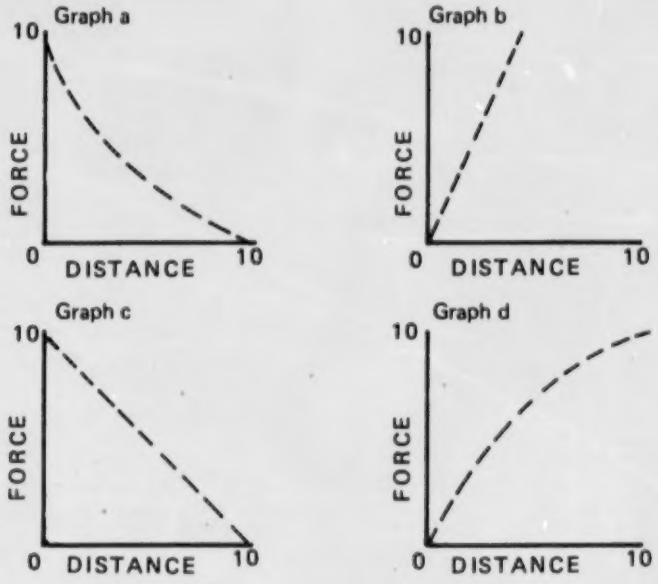
1. Did the mass of the camera change during the trip?
2. What have you learned about *mass* that supports your answer?

Answer both 1 and 2 below by selecting the letter that best completes the sentence in each case. **04-Exc 16-1C**

1. Excursion 16, "Forerunners of Space Travel," tells how eleven men who lived from 400 B.C. to 1725 A.D. developed ideas about astronomy. One thing that all of these men did was
   a. use mathematics to solve problems.
   b. make observations of planet and star movements.
   c. contribute new ideas.
   d. build rockets or spaceships.
2. Newton said, "If I have seen further than other men, it is because I have stood on the shoulders of giants." He meant that
   a. Galileo's telescope helped him to see galaxies no one else had seen.
   b. he was short himself but could see farther when someone held him up.
   c. he could visit their tombs and steal their books.
   d. he had the advantage of others' ideas and could improve and advance them.

Each of the following four statements describes a relationship between the variables distance and force. Beside the number of each statement, record the letter of the graph below which shows the same relationship. **04-Exc 17-1C**

1. As distance increases, force decreases at a constant rate.
2. As distance increases, force increases at a constant rate.
3. As distance increases, force decreases at a changing rate.
4. As distance increases, force increases at a changing rate.

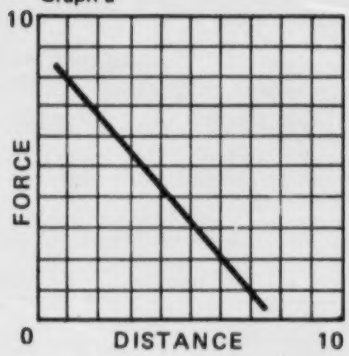


04-Exc 18-1C

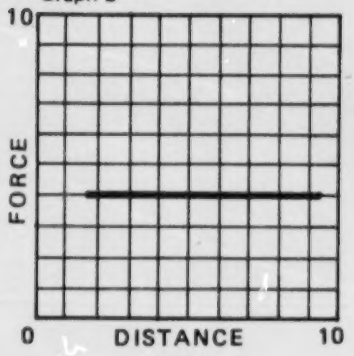
For each of the following four statements, match the letter of each graph that shows the relationship stated. You may use the letter of a graph more than once.

1. When distance increases at a constant rate, force increases at a constant rate.
2. When distance increases at a constant rate, force is not changed.
3. When distance increases at a constant rate, force decreases at a constant rate.
4. When distance decreases at a constant rate, force increases at a constant rate.

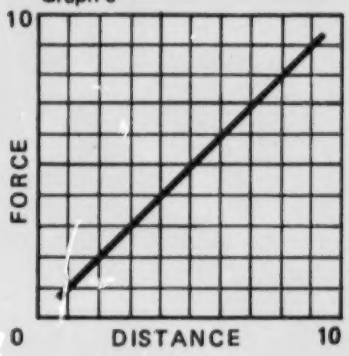
Graph a



Graph b



Graph c



04-Exc 19-1C

Two wagons with eggs in them are coasting down the hill toward a brick wall at the bottom. One wagon and its content has a mass of 40 kg and a speed of 10 meters per second. The mass of the other is 10 kg, and its speed is 40 meters per second. Use the formula $KE = \frac{1}{2}ms^2$ to answer the following questions. Your answers will be in newton-meters.

1. Determine which wagon has the greater kinetic energy and how much more it has. Show your calculations.
2. Which wagon would be more difficult to stop?

When a piece of elastic has been stretched, what kind of energy does it have? **05-Core-1C**

05-Core-2C

	Trial 1	Trial 2
Average force of blade	7.1 N	8.3 N
Distance blade tip moved	0.045 m	0.018 m
Work done on cart	0.302 N·m	0.140 N·m

Calvin used his force measurer as the input work supplier to his water-clock cart. When he studied his data, he saw that in Trial 1 he had used a smaller force than in Trial 2. He then noticed that more work had been done on the cart using the smaller force. Could this be true? Explain your answer.

Lisa was given a doll which talked when she pulled a string on its back. Pulling the string winds up a spring which causes sound as the spring unwinds. She found that it took 1.5 newtons of force to start to pull the string. The force increased to 2.5 newtons when the string was fully pulled out. The string was 0.21 m long. What was the potential energy of the "voice" of the doll when it was fully wound up? **05-Core-3C**

Operationally define *kinetic energy*. **05-Core-4C**

A motor has just been disconnected from a battery. How can you tell if the motor pulley still has kinetic energy? **05-Core-5C**

How can you measure the amount of kinetic energy a moving bicycle has? **05-Core-6C**

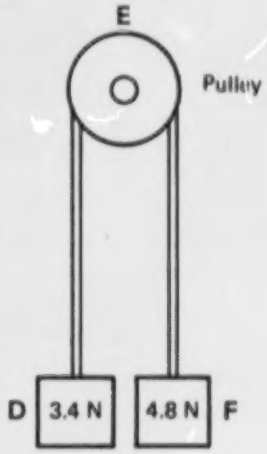
Robin Hood had five positions on his crossbow. Each position had a different amount of energy. **05-Core-7C**

1. Identify by letter the position at which the bow had the most potential energy.
2. Identify by letter the position at which the bow had the most kinetic (motion) energy after it was released.

05-Core-8C

An object at D weighs 3.4 N. A second object at F weighs 4.8 N.

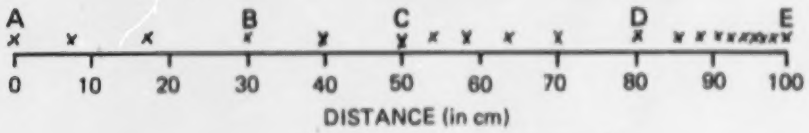
1. Which of the following states the direction of movement: D to E or F to E?
2. Which of the following correctly states the amount of force acting to produce the motion: 1.4 N, 8.2 N, or 16.4 N?



05-Core-9C

Look at the record below of the movement of a water-clock cart. This record was made by a moving cart which dropped a drop of water every two seconds.

1. List the letters between which the cart's speed is increasing.
2. List the letters between which the cart's speed is decreasing.
3. List the letters between which the cart's speed is constant.



05-Core-10C

Laverne placed a ball at the top of an inclined sheet of glass. What force caused the ball to roll down the incline?

05-Core-11C

Johnny said he could roll a bowling ball all the way from one end to the other end of the school's longest hallway. However, the ball gradually slowed down and stopped after rolling about 220 feet. What force caused the ball to slow down and stop?

05-Core-12C

An electric can opener is an energy converter in which electrical energy is changed into useful output kinetic energy. But when output mechanical energy is measured, it is always less than the input electrical energy. What force causes this decrease?

1. Write the letter of the choice that completes the following sentence best. When 84 newton-meters of input work is done by a horse on a treadmill, the treadmill might do

   a. 198 newton-meters of output work.
   b. 84 newton-meters of output work.
   c. 33 newton-meters of output work.

2. Write the letter of the reason for your choice.

   a. Because input work is always greater than output work
   b. Because the horse doesn't waste any energy
   c. Because the treadmill saves work, as a machine does

05-Core-13C

Choose the correct word to complete the following sentence. When starting a race from a standstill position, Richard Petty always spins the rear wheels of his Plymouth racer. The wheel-spinning causes the temperature of the tires to (stay the same, increase, decrease).

05-Core-14C

What are six forms of energy?

05-Core-15C

Think of the changes in energy that occur in the following situation. A box

1. is lifted from the floor,
2. reaches its maximum height of 2 m and stops,
3. falls, and
4. is about to strike the floor.

For each numbered step above, select two things from the table below – the letter (a, b, c, or d) of the phrase which describes the potential energy of the box at that moment and a letter (m, n, o, or p) which describes the kinetic energy of the box at the same moment.

05-Core-16C

Potential Energy	Kinetic Energy
a. gains potential energy	m. greatest kinetic energy
b. loses potential energy	n. gains kinetic energy
c. lowest potential energy	o. receives input of kinetic energy
d. greatest potential energy	p. no kinetic energy

Describe a method to prove that light can do work and therefore is a form of energy. Also state what you would need to do to measure the amount or intensity of light energy.

05-Core-17C

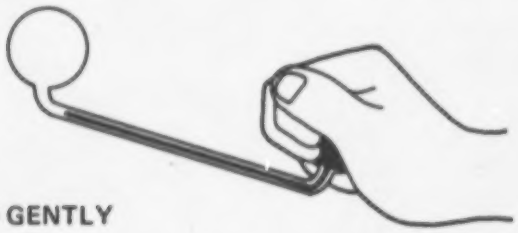
Miss Duncan, the ISCS teacher, said that her students can prove that light is a form of energy because they use an instrument which works when light energy operates it. Name an instrument that shows light is a form of energy. Tell how the device shows that work is being done.

05-Core-18C

05-Core-19C

Get a palm glass, and tilt it until all the liquid is in one of the bulbs. Hold the full bulb gently in your hand, as shown in the picture below. Be sure the cross tube is below the bulbs and the empty bulb is higher. Choose the correct answer below. What causes the liquid to move toward the other bulb?

a. Gravity
b. Personal magnetism
c. Heat energy
d. Sound energy



CAUTION: HOLD GENTLY

05-Core-20C

Give two examples in which electrical energy is changed into kinetic energy.

05-Core-21C

Read the following story. While working on Chapter 10, Cyrus put nails into holes 1 and 3 of the force measurer and pushed the cart back until the blade touched the nail in hole 3. (You may look at a force measurer if you wish.) Then he observed the following things.

1. The blade was bent back.
2. The blade went forward (from hole 3 to hole 1), pushing the cart.
3. The cart lifted the sinkers.

His partner stopped the cart, but it slipped.

4. The sinkers began to fall, and the cart sped backwards.
5. The blade bent back when the cart hit it.
6. The cart was motionless.

Beside the number of each step, write P-K if potential energy is being changed to kinetic energy and K-P if kinetic energy is being changed to potential energy. Write N if there is no change in the form of energy.

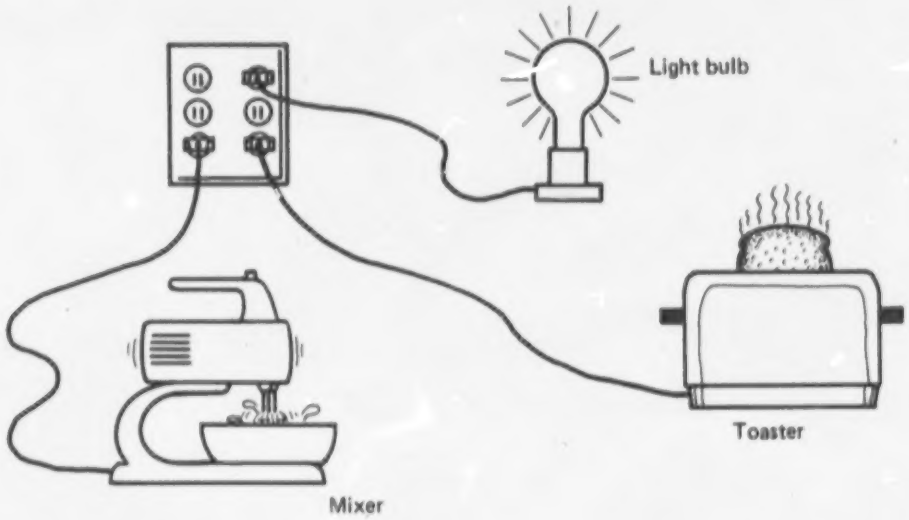
05-Core-22C

Write the letter of each true statement about energy.

a. Energy can be transferred from one system to another.
b. Energy can be destroyed.
c. Energy can exist in more than one form.
d. Energy can be measured by the amount of space it occupies.
e. Energy can be changed from one form to another.

Examine the diagram below. **05-Core-23C**

1. State the form or forms of input energy shown in the diagram.
2. State the form or forms of output energy shown in the diagram.



In every room in your home there is probably at least one energy converter. **05-Core-24C**

1. List three energy converters found in your home.
2. After each, state the forms of the input and output energy. For example, light bulb: input energy – electrical; output energy – heat and light.

A water clock drips 35 drops in 17 seconds. The water-clock cart leaves a trail of water drops 5 cm apart. What is the speed of the cart in centimeters per second? **05-Exc 20-1C**

Roosevelt, an ISCS student, watched a beetle walking around the circumference of a spinigig disk which hung in the rack. He timed one of the trips around and found it took the beetle 7 seconds. How far did the beetle walk? At what speed was it moving? You may get a spinigig, 50 cm string, and a meterstick to make whatever measurements you need. Show your measurements and your calculations. Report your answer in centimeters per second. **05-Exc 21-1C**

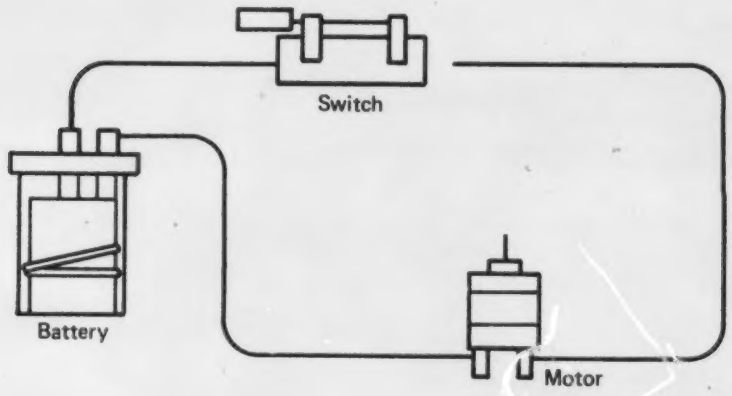
The following things are known about a space missile. **05-Exc 22-1C**

a. It has a mass of 400 mass units.
b. It has a speed of 21,000 miles per hour.
c. It can accelerate in flight with an additional thrust of 1,200 lbs for 22 sec.
d. It can accelerate from 0 to 3,000 miles per hour in two seconds.

Write the letter of each variable needed to calculate the missile's momentum.

Assume that the equipment shown in the diagram below is all in good working order. **06-Core-1C**

1. Will the motor run?
2. Why do you believe the motor will or will not run?



Get the bottle of blue solution labeled 06-Core-2. Before you finished Chapter 12, you identified a material in this same solution which coated the carbon rod reddish brown. Which of the following materials was in the solution? **06-Core-2C**

a. oxygen
b. water
c. copper
d. sulfate

What is the coating on the carbon rod in box 06-Core-3 made of? It was produced during the activities done in Chapter 12. **06-Core-3C**

A truck battery is connected to a heavy-duty electrical charger. Select the letter of the sentence below which describes the energy conversion that takes place within the battery during the charging. **06-Core-4C**

a. Electrical energy is changed into light energy.
b. Electrical energy is changed into chemical energy.
c. Chemical energy is changed into electrical energy.
d. Kinetic energy is changed into electrical energy.

What form of energy is stored in a battery? **06-Core-5C**

1. What happens inside a rechargeable battery in a portable tape recorder during charging? **06-Core-6C**
2. When it discharges to the tape recorder, what happens inside the battery?

Laura has a battery, a bulb, and two test leads. What must she do to make a complete electrical circuit? You may use a diagram as part of your answer. **06-Core-7C**

06-Core-8C Go get 1 charged flashlight battery, 2 bulbs and sockets, and 3 test leads. Using these materials, connect the two bulbs in a series circuit. Show your teacher what you have done.

06-Core-9C Diagram a circuit which shows a battery, a switch, a bulb, and two motors all connected in series.

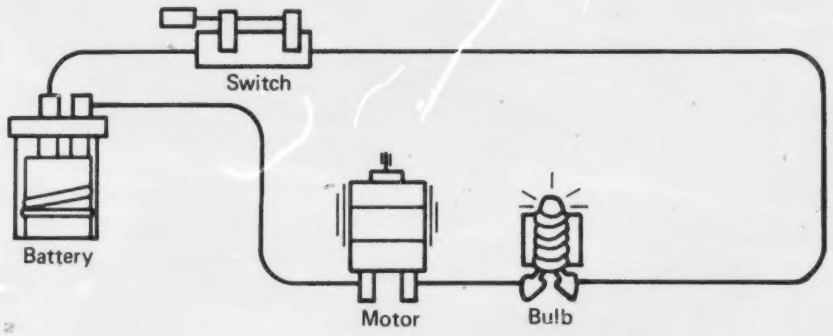
06-Core-10C For each of the following statements, state whether the electrical devices mentioned are wired in *parallel* or in *series* with each other. Write *series* or *parallel* on your answer sheet next to the number of each statement.

1. When the switch on a lamp is turned off, the light goes out. When the switch is turned on, the bulb burns brightly. How are the switch on the lamp and the bulb wired?
2. A lamp has two light bulbs in it. One bulb is 60 watts. The other bulb is 100 watts. The lamp is turned on, and the 60-watt bulb burns out. But the 100-watt bulb still stays on. How are the two bulbs in the lamp wired?
3. A toaster and a light are both plugged into the receptacles of a wall outlet. The toast pops up, and the toaster shuts off. But the light remains on. How are the toaster and the light wired?

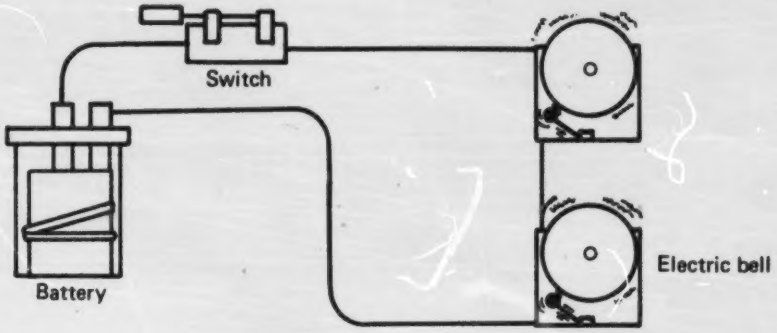
06-Core-11C Diagram a circuit which shows a battery, a motor, and two bulbs wired in parallel.

06-Core-12C Get the following: 1 "D" size charged battery, 3 bulbs and sockets, and 6 test leads. Using these materials, connect the three bulbs in a parallel circuit. Show your teacher what you have done.

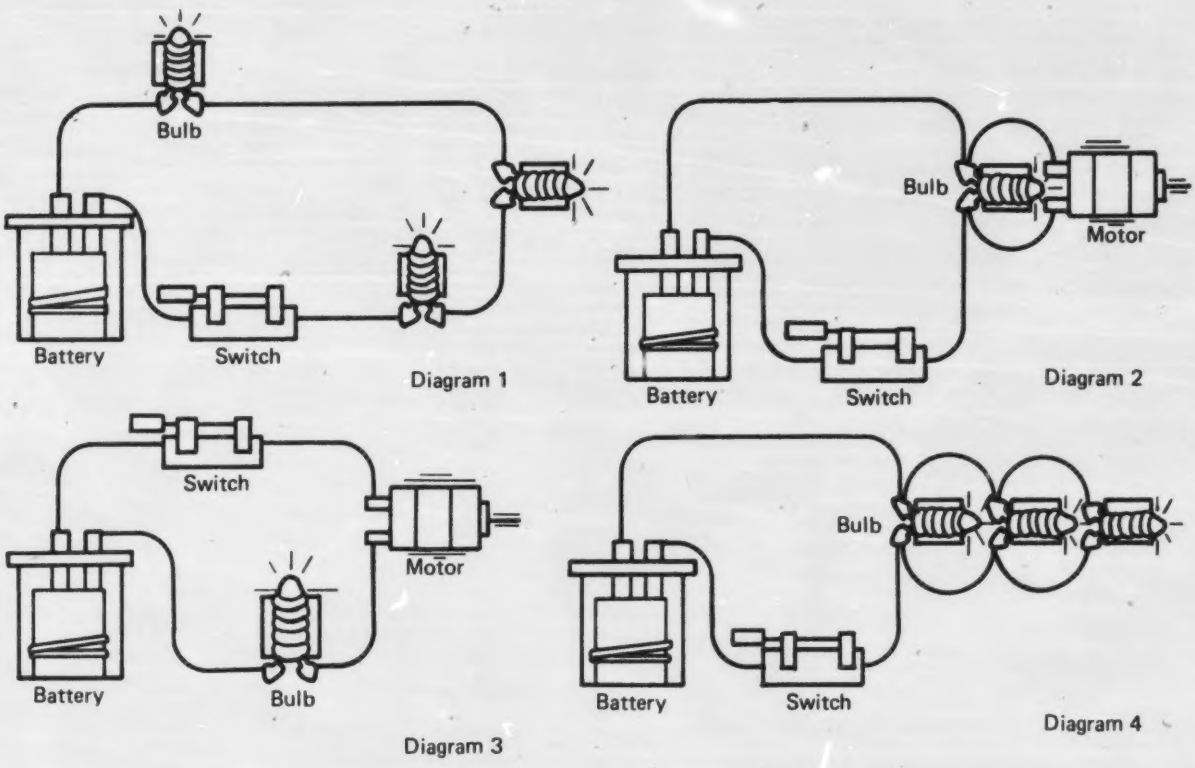
06-Core-13C Look at the circuit diagramed below. Suppose you added a resistor in series with the circuit. What affect would this have on the amount of electrical energy the motor and the bulb in this circuit receive?



The amount of current flowing in the circuit diagramed below can be reduced in several ways. State one way in which the current can be reduced, but not stopped. **06-Core-14C**

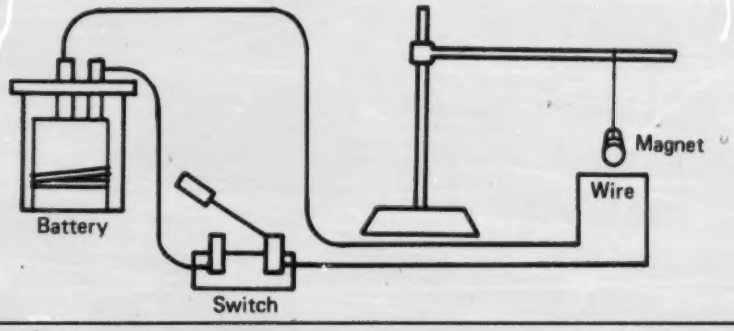


Each diagram below represents either a series or a parallel circuit. On your paper, beside the number of each diagram, name the type of circuit it shows. **06-Core-15C**



06-Core-16C The temperature of a resistor rises when electricity is passed through it. Why does this temperature rise take place?

06-Core-17C Look at the diagram below. A piece of copper wire is placed next to a magnet that is hung by a fine string from a support, so that it is free to move. What will happen when the switch is closed?



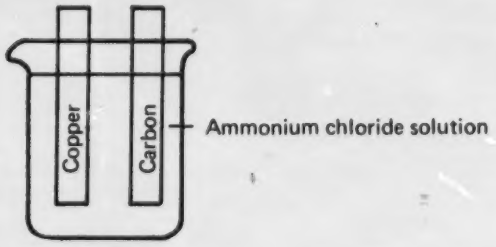
06-Core-18C Describe how changing the number of loops in a coil of wire affects the magnetic strength of the coil.

06-Core-19C Record the letter of each statement below which identifies a characteristic of energy. Energy can

a. be transferred from one system to another.
b. exist in more than one form.
c. be measured by speed multiplied by distance.
d. be destroyed.

06-Exc 23-1C This battery, as it is pictured, will not produce enough electricity to light a bulb. Write the letter of any change listed below which would enable the battery to produce more electrical energy.

a. Using a beaker rather than a battery jar
b. Using strips made of different metals
c. Using a different solution, such as copper sulfate.
d. Using two zinc metal strips instead of the carbon and copper strips.



Chemical energy can be stored and then changed to other forms. Write the letter of any sentences below in which it is possible to say that the stored chemical energy is changing to other forms. **06-Exc 24-1C**

a. The brown coating on the lead strip in your ISCS battery disappeared when electricity was produced.

b. The zinc metal strip turned copper colored when placed in copper sulfate solution and the solution got hot.

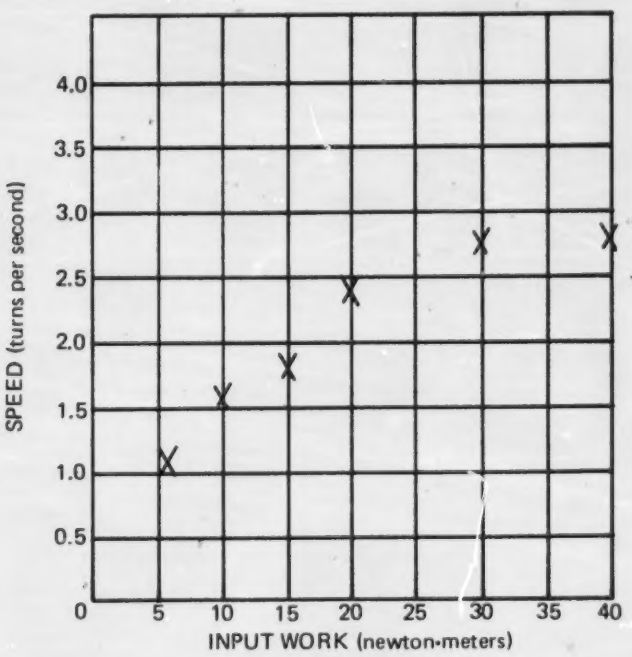
c. The addition of glycerine to potassium permanganate resulted in the scattering about of the chemicals.

d. None of those are correct.

Wes measures the volume of a chemical solution, using a calibrated beaker. He gets a volume of 240 ml. Next he uses a volumetric flask, which chemists accept as a more precise measuring device. He gets a volume of 250 ml. Finally, he uses a graduated cylinder and gets a volume of 250.58 ml. Wes says now he knows that the 240 ml volume he recorded earlier is in error and that the solution is exaclty 250.58 ml. **06-Exc 25-1C**

1. Do you agree or disagree with Wes?
2. Why?

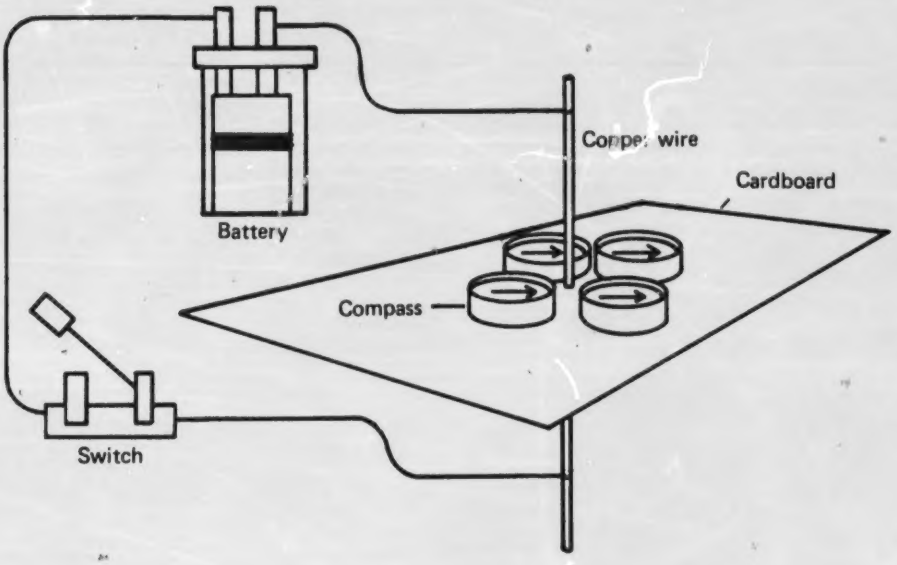
Luz plotted points for data she collected using a spinigig. The points were located as shown on the grid below. Get grid paper from your teacher. Label the axis, and plot the points as shown below. The draw the best-fit line for the points. **06-Exc 25-2C**



06-Exc 26-1C The electrical outlets in Iggy's house are wired in parallel. Write the letter of the sentence below that explains what that means.

a. The circuit contains more light bulbs than if it had been wired in series.
b. The TV, stove, and air conditioner will not work unless all three are switched on.
c. The circuit permits the current to flow through any of several possible paths.
d. If the TV is switched off, the fan also stops running.
e. All of the above are correct.

06-Exc 27-1C The following diagram shows a copper wire passing through a piece of cardboard on which several compasses have been placed. On your answer sheet, trace the cardboard and compasses. Then, use arrows to show the direction the compass needles will point when the switch is closed and electricity is passing through the wire.



Select the answer which is not true of a scientific model. **07-Core-1C**

a. It is an experimental observation.
b. It may in some cases be represented by a physical object or sketch.
c. It is useful.
d. It explains observations.

Select the best answer. Scientific models come into existence by being **07-Core-2C**

a. found among data and pieced together.
b. thought up by men, using their observations.
c. extracted from nature, using microscopes.
d. discovered in nature, using telescopes.

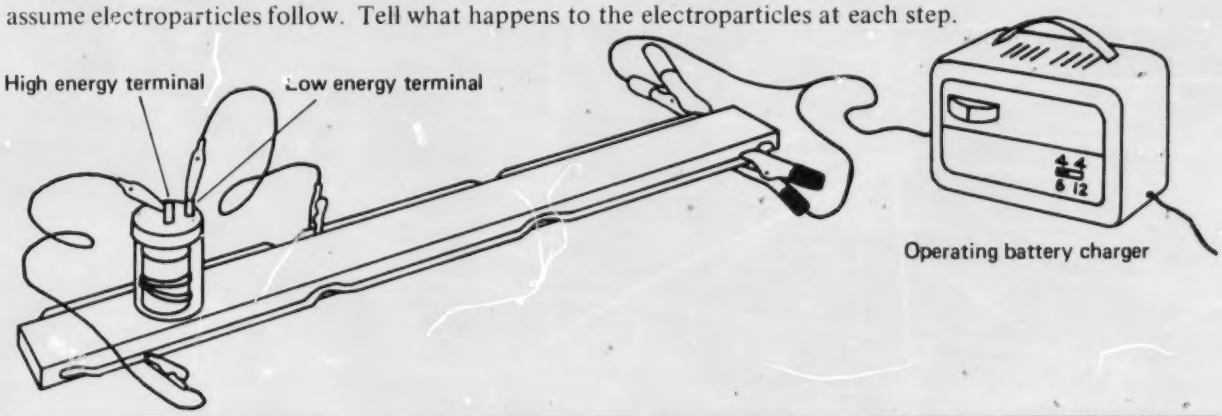
Give two things that are done by a good scientific model. **07-Core-3C**

Select the statement below which best fits your understanding of the models that scientists use. A scientific model **07-Core-4C**

a. is not used because it is correct, but because it is useful in explaining observations and predicting other observations.
b. cannot be shown to be incorrect.
c. provides correct answers to all scientific questions.
d. describes what actually happens in nature and therefore is correct.

Electricity is explained simply in ISCS by the electroparticle model. What are three things that are assumed to be true of the electroparticle in that model? **07-Core-5C**

The ISCS electroparticle model explains how an ISCS battery is charged. On your answer sheet, describe the path through the battery-battery charger circuit that we assume electroparticles follow. Tell what happens to the electroparticles at each step. **07-Core-6C**



Dr. Herchel Hebbs, a scientist, wants to develop a new model to explain solar radiation. Can more than one model be developed which can be used to explain solar radiation? If not, why not? If so, how would a scientist decide which model to use? **07-Core-7C**

07-Core-8C Use the electroparticle model to describe what happens during the process of charging a battery.

07-Core-9C When a charged battery is connected to an electric motor and the circuit is complete, the motor runs. Using the ISCS electroparticle model, explain how the energy travels through the circuit and how it makes the motor run.

07-Core-10C Use the ISCS electroparticle model for electricity to describe what happens at the poles (terminals) of a battery when there is a complete circuit to a light bulb.

07-Core-11C What does adding a resistor do to the current flowing in a circuit? Use the electroparticle model to explain what happens.

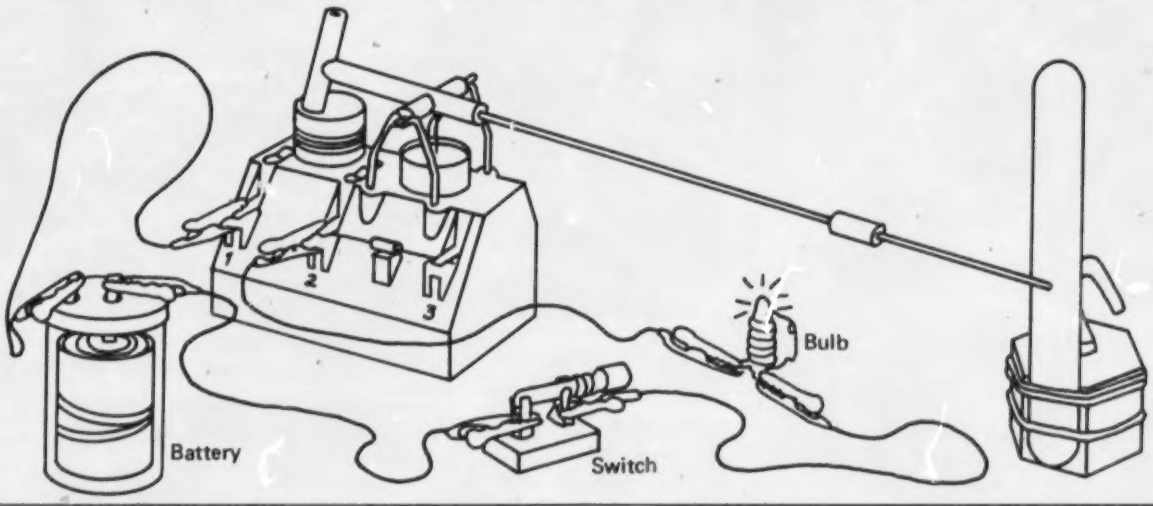
07-Core-12C A circuit contains a charged battery, a resistor, and a buzzer. Which factor in the list below determines how many electroparticles will pass through the resistor in two minutes if the battery has a good charge?

a. The charge of the battery
b. The energy of each electroparticle
c. The size of the electric motor
d. The size of the electroparticles

07-Core-13C The ISCS electroparticle model does not help you understand several things about electricity flow. What are three of them?

07-Core-14C To measure the current received by a circuit, you must connect an ammeter in series with the circuit. Why?

07-Core-15C Study the diagram below to determine how the electricity measurer is connected in the circuit. When it is connected in this manner, what does it measure?



Select the best answer below. Accepted units of measurement come into existence when they are **07-Core-16C**

a. experimentally discovered by scientists.
b. set by nature.
c. found by experience.
d. defined by people.

One way to describe electricity is to use the electroparticle model. Use this model to describe what happens during the process of charging a battery. **07-Core-17C**

Name the standard unit used for measuring electrical current. **07-Core-18C**

An electricity measurer is set up to measure electrical energy carried by an electroparticle. What is the unit of measurement commonly used? **07-Core-19C**

Carefully study the setup your teacher has assembled in box 07-Core-20. As it is set up it is an ammeter. Change it to a voltmeter. Show your setup to your teacher. **07-Core-20C**

Get an ISCS electricity measurer kit, four D batteries in holders, five test leads, and a blank tongue depressor mounted on a ½ kg mass with rubber bands. Using these materials, make a voltmeter scale for the electricity measurer. **07-Core-21C**

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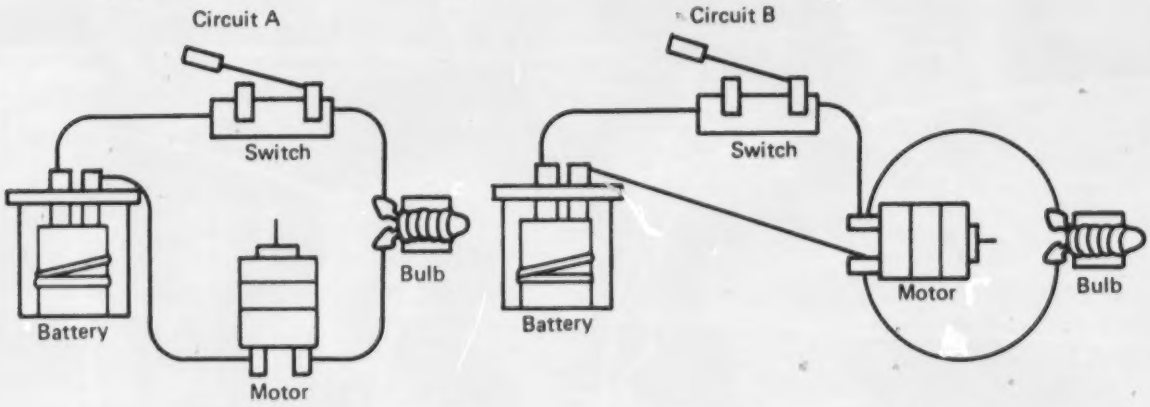
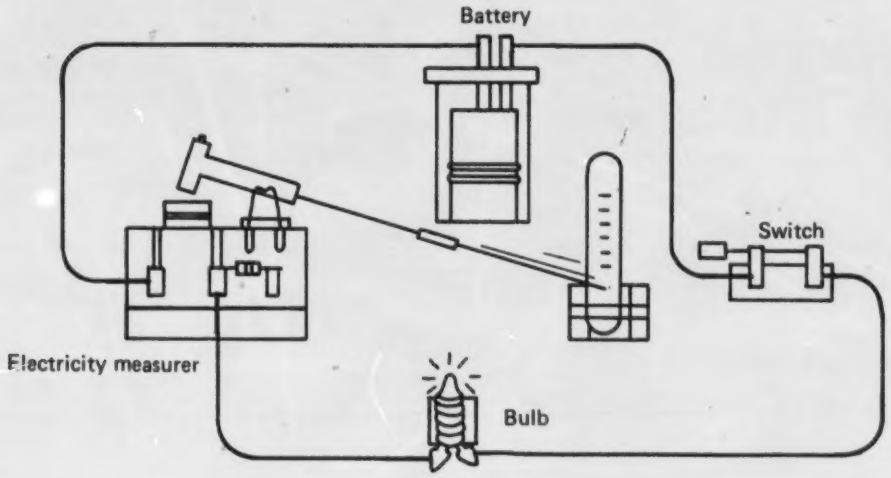
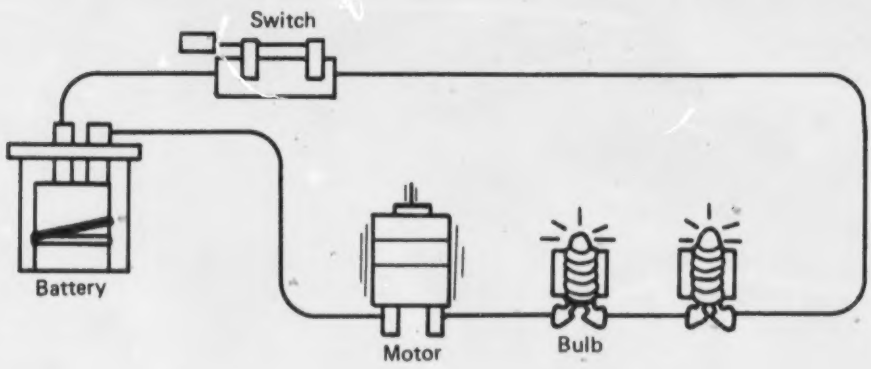
1. Construct circuit A. Close the switch and measure the current flow, and report your measurements. Show your ammeter hookup to your teacher.
2. Then hook up circuit B. Close the switch and measure and record the total current flowing in the circuit. Show your hookup to your teacher. **07-Core-22C**



07-Core-23C Look at the diagram of the electricity measurer and circuit. The pointer of the electricity measurer is deflecting down, not up. How can you change the direction that the pointer of the electricity measurer deflects.?



07-Core-24C Suppose another bulb or motor were added in series in this circuit. What effect would this have on the amount of electrical energy each of the bulbs in this circuit receives?



An overturned raft in the middle of Lake Michigan is all that searchers are able to find after searching for a missing ship. Dropping down to the surface of the lake from a plane, a frogman produces a wave which passes under the overturned raft. Which of the following statements best describes the motion of the raft in the water? **07-Exc 28-1C**

a. Impossible to answer unless you know if the waves are moving away from or towards the frogman
b. Up and down in nearly the same spot
c. Towards the frogman
d. Away from the frogman

Fill a water trough with 2 inches of water, and place a cork in the middle of the trough. Make a series of waves by slowly tapping one end of the water surface with a pencil. Does the cork-water system move horizontally toward or away from the wave source, or doesn't the system move horizontally at all? What, if anything, travels across the water's surface? **07-Exc 28-2C**

Read the following story. Assume that both persons are stating correct facts. Professor A.C. Decy teaches workers to make series circuits for mechanical dolls. The professor uses a particle model of electricity to explain series circuits. This model is fairly simple and explains all the observations the workers will make. A new professor, Ima Volt, is replacing Professor Decy. She insists that people learn a new and more difficult model of electricity to explain series circuits. Is Professor Volt right to say that because the particle model is incomplete, it is wrong and should never be used? Explain your answer. **07-Exc 28-3C**

Select the best answer below. The positron, one of the smallest units of matter possible, is a model proposed to explain some of the behavior of atoms. Most scientists will accept the positron model **07-Exc 29-1C**

a. only if they change the observations made before the positron was proposed.
b. only if it does not cause a change in the atomic model.
c. if no other model can describe all known observations.
d. if thinking about atoms as made up of small positrons is useful.

Suppose that in 1970 a scientific journal reported that the wave model for sound was accepted by most scientists. This would mean that **07-Exc 29-2C**

a. at least a few scientists had observed sound traveling as waves.
b. sound had the exact properties of a water wave.
c. they had direct proof that sound traveled in waves.
d. thinking about sound as though it traveled in waves explained the observations made to that date.
e. no other model could fit the observations made to date.

07-Exc 29-3C

Pretend that nearly all scientists accept the electroparticle model of electricity described in Excursion 29. Select the sentence below which best describes one of the things that acceptance implies.

a. The model must be revised to incorporate any new observations that don't agree with it.
b. Scientists have seen electricity traveling as electroparticles.
c. Electricity has the exact properties of an electroparticle.
d. It answers all their questions about electricity.
e. None of the above are correct.

07-Exc 30-1C

Two wires, A and B, are positioned as in Diagram 1 when the switches are open. Diagram 2 shows that when the switches are closed, wires A and B will attract each other. Suppose that in Diagram 2 in the circuit containing wire A the electroparticles come out of the battery through terminal 1 and reenter the battery through terminal 2.

1. Through which terminal in the circuit containing wire B do the electroparticles come out of the battery?
2. Through which terminal in the circuit containing wire B do the electroparticles go back into the battery?

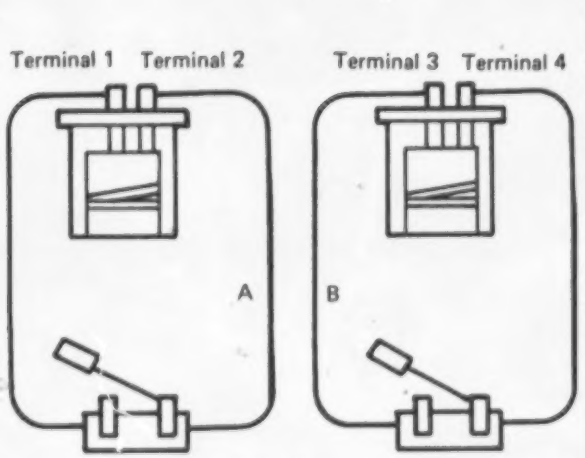


Diagram 1

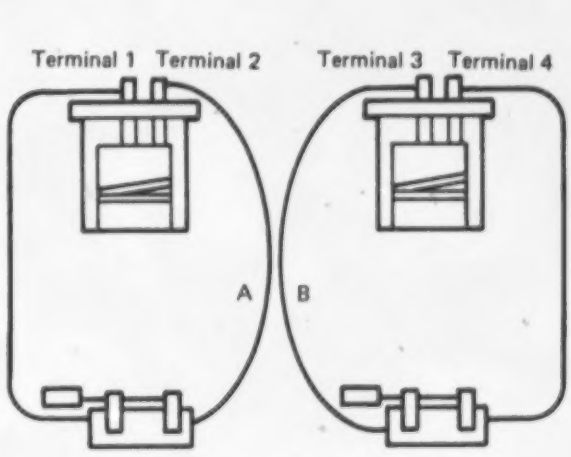


Diagram 2

07-Exc 31-1C

Which of the following statements is the best description of scientists?

a. Scientists' personalities vary like those of any other group of people.
b. Scientists are interested only in their scientific work.
c. Scientists are a group of people who were geniuses even as children.
d. Scientists all wear white coats and thoughtful frowns.
e. Scientists all exhibit behavior patterns like Ampere's.

Two different toy companies manufacture battery-operated, tail-wagging dogs called Peter and Hank. Each dog runs on two batteries. Hank wags his tail more slowly but for a greater length of time than Peter does. Are the batteries in Hank connected in series or in parallel? How are the batteries in Peter connected? Explain your answers, using the electroparticle model. **07-Exc 32-1C**

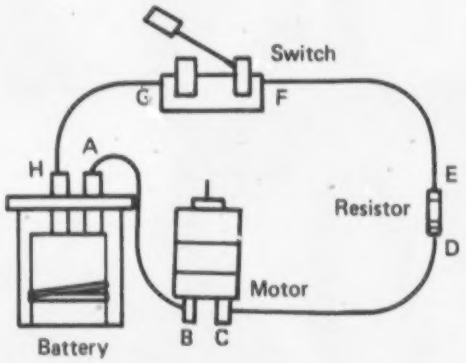
A toy manufacturer decides to improve his talking horse which operates on two batteries connected in series. The motor that turns the head and the motor that operates the jaws can be thought of as two resistors. The new improved talking horse is to swish his tail. This means a third motor which can be thought of as a resistor, too, and the toy will use a third battery, wired in parallel. Will a voltmeter reading taken in the new improved toy horse be more than, equal to, or less than a voltmeter reading taken in the older version of the toy horse? Explain your answer, using the electroparticle model. **07-Exc 33-1C**

A toy manufacturer decides to improve his toy walking dog which operates on two batteries and two motors connected in series. The motor that wags the tail and the motor that moves the legs can be thought of as two resistors. The new, improved toy dog is to bark. This feature will be worked by another motor – a third resistor the same size as the other two. In addition the manufacturer plans to add a third battery in series. Will an ammeter reading taken in the new, improved toy dog be more than, equal to, or less than an ammeter reading taken in the older model? Explain your answer, using the electroparticle model. **07-Exc 33-2C**

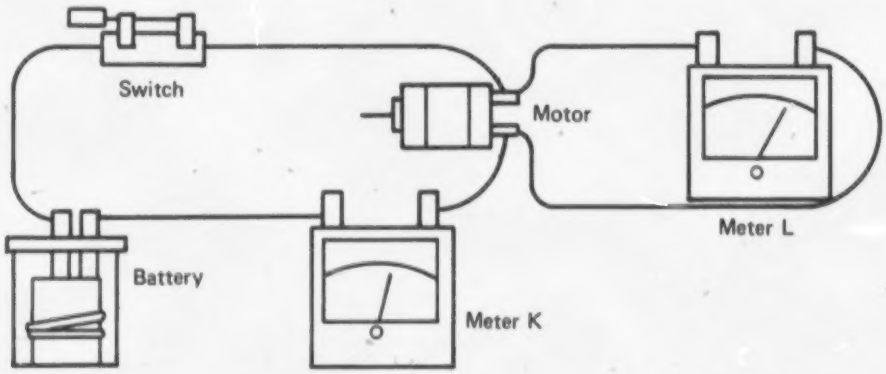
You must connect an ammeter in series with a circuit, rather than parallel to it, to measure the current flow through the circuit. Use the electroparticle model to explain why. **08-Core-1C**

Suppose you need to measure the voltage available to a light bulb in a circuit. How can a voltmeter be connected into a circuit to obtain this measurement? If you wish, you may use a diagram as part of your answer. **08-Core-2C**

Study the circuit below. Describe how you could detect and measure voltage at the motor when the switch is closed. Name any other piece of equipment you may need. Tell which letters on the diagram show the places where the equipment should be connected. **08-Core-3C**



In the diagram below, the meters are correctly connected to measure current and voltage. Decide for yourself how each meter is connected and whether it is an ammeter or a voltmeter. Then, record on your answer sheet the words in parentheses that best complete the statements below. **08-Core-4C**



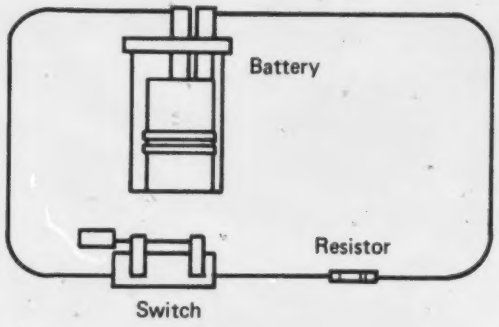
1. Meter K is connected in (series, parallel) with the motor. Therefore, Meter K is (an ammeter, a voltmeter).
2. Since Meter L is connected in (series, parallel) with the motor, it is (an ammeter, a voltmeter).

08-Core-5C A light bulb receives 1.3 amperes and 4 volts for 10 seconds. Find the total electrical energy received by the bulb. Show your work, and use the correct units.

08-Core-6C Choose the correct answer below. What is the formula for calculating the total electrical energy supplied in a given circuit?

a. Volts times amperes divided by time
b. Volts minus amperes minus time
c. Volts plus amperes minus time
d. Volts times amperes times time

08-Core-7C Below is a diagram of a complete circuit in which a resistor is connected. Three variables must be measured to find the total amount of electrical energy received by the resistor. Name them.



08-Core-8C Get the assembled circuit in box 08-Core-8C, an electricity measurer, a timer, voltmeter and ammeter scales, and two test leads. Disconnect the battery, charge it, and replace it in the circuit. Measure how much electrical energy is supplied to the motor in the bulb-motor arrangement in a fifteen-second period. Report your measurements and calculations.

08-Core-9C Dr. Flowers sent two students to study the insect population in an unsprayed area of an orchard. Their observations are shown in the chart below.

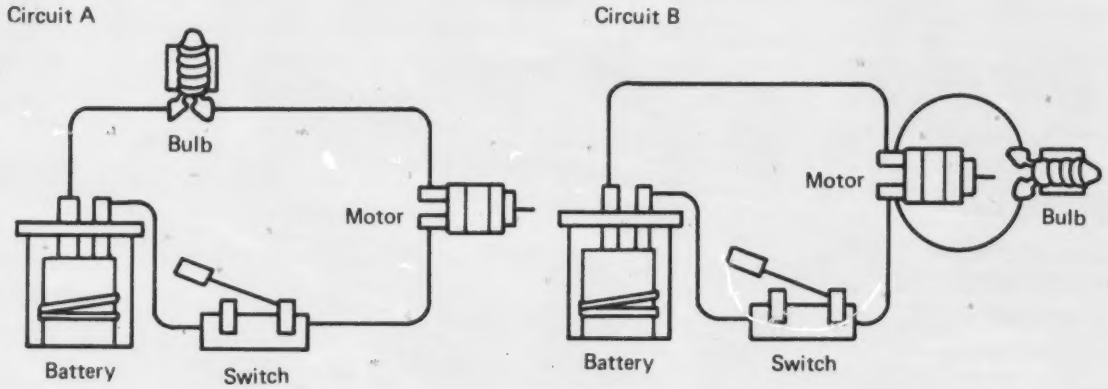
Student	No. of Kinds of Insects	Eggs Seen	Food	No. of Legs	Kinds Seen Alone	Kinds Seen in Large Groups
Jack	heaps of them	many kinds	anything	same on all	many	few
Jean	175	65 kinds	15 different kinds of plants	6	65	3

For what two reasons do scientists prefer the kind of observations Jean made?

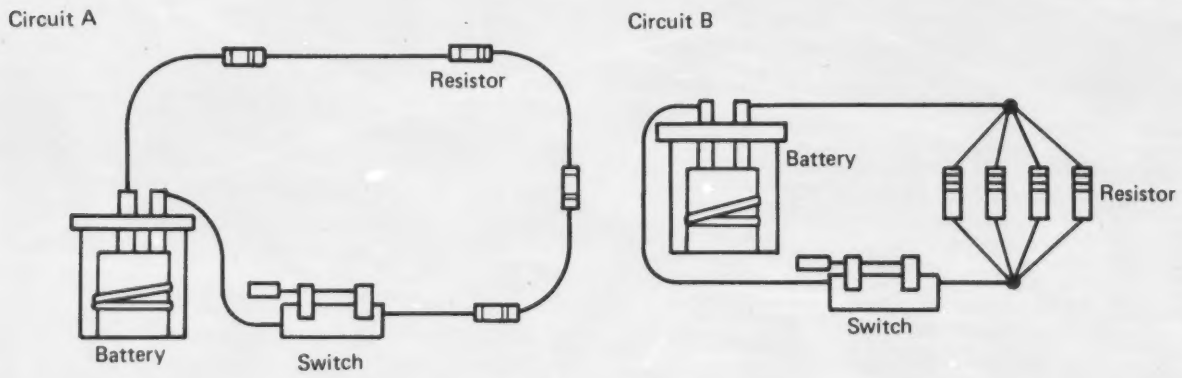
From the list below, select those items in which electricity does observable work. Electrical energy **08-Core-10C**

a. operates an electric lawn mower.
b. lights a bulb.
c. operates a motor.
d. operates a radio.
e. operates an elevator.

The diagrams below are of two electrical circuits labeled Circuits A and B. Get a voltmeter and the materials to construct the circuits. After constructing the circuits as shown, measure the voltage across each entire circuit. Record the voltages, and show your setup to your teacher. Be sure your battery is charged before you make your measurements. **08-Core-11C**

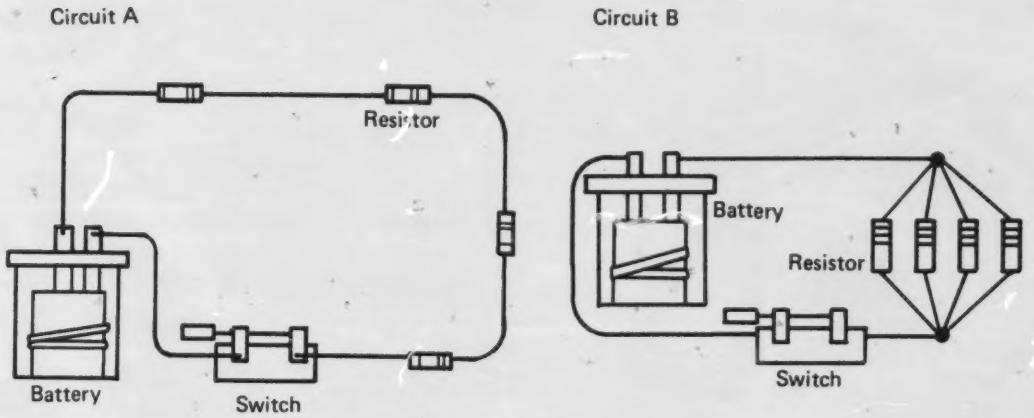


Circuits A and B are shown below. Each contains one ISCS battery and four resistors connected by test leads. However, Circuit A has more resistance to current flow than Circuit B. All resistors in Circuits A and B are of the same type. Why does Circuit A have more total resistance than Circuit B? **08-Core-12C**

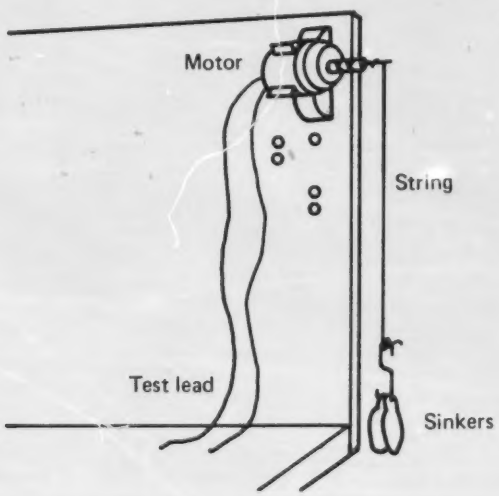


08-Core-13C Both Circuit A and Circuit B below have identical components, but they are connected differently. Select the phrases in parentheses which best complete the sentences.

1. In Circuit A, the current flows through (each resistor by a separate path, all resistors one after another).
2. In Circuit A, the total resistance to current flow is (less than, greater than) the current flow in Circuit B.



08-Core-14C Operationally define *battery energy*, using the equipment below. (Hint: Remember that an operational definition answers two questions.)



Consider the following situation in which cans of tomato juice represent energy being supplied from one location to another. After the number of each question, write the letter of the statement below which answers it best. **08-Exc 34-1C**

A large number of 32 ounce cans of tomato juice are to be removed from the stockroom and placed on a shelf on the other side of the supermarket.

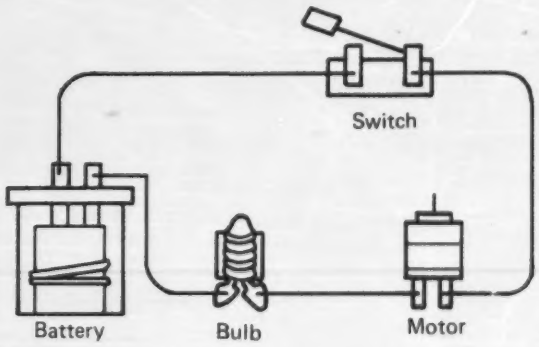
1. Which part of the operation is most like an ampere?
2. Which part of the operation is most like an electroparticle?
3. Which part of the operation is most like a volt?

a. The number of cans a person can carry at one time
b. The age of the juice
c. The number of cans put on the shelf per hour
d. The number of persons available to move the cans
e. The length of time a person works

There is a floor lamp next to Iggy's favorite reading chair. Record the letters of all the variables in the list below which affect the power received by the bulb when it is turned on. **08-Exc 35-1C**

a. The bulb releases 20 calories of heat per minute.
b. The stereo is turned on.
c. There are two other lighted 100-watt bulbs in the room.
d. The voltage reading at the lamp is 120 volts.
e. The bulb is a soft-white bulb.
f. The current flowing through the lamp is one ampere.

Set up the circuit as shown in the diagram. Be sure you use a freshly charged battery. Then connect one electricity measurer as an ammeter and the other as a voltmeter to measure the current flow and voltage of this circuit. Calculate the power of the circuit. Record your answer, and show it to your teacher before you dismantle your setup. **08-Exc 35-2C**



08-Exc 36-1C

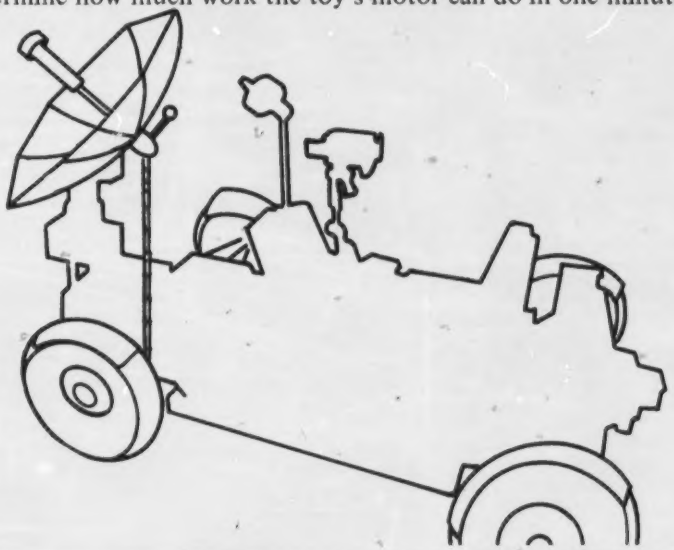
The wires in a model race car are all made of the same thickness of copper. The resistance of the wire is 4 ohms when the voltage is 12 volts and the current is 3 amps. A different model of this race car is identical except that more batteries are required, thus producing more voltage and current. What would you expect the resistance of the wire to be in this version of the race car – more than, equal to, or less than 4 ohms? Explain your answer, using the electroparticle model.

08-Exc 37-1C

Get the box labeled 08-Exc 37-1. What will happen if one of the magnets is turned upside down? Explain your answer.

08-Exc 38-1C

The motor inside the toy lunar rover raises an antenna. What would you need to know to determine how much work the toy's motor can do in one minute?



08-Exc 39-1C

"You have learned about electricity from activities like the ones in the textbook without too much trouble. It was the explorers who had a hard time."

You may refer to Excursion 39 from which the above statements were taken. What helps have you had in learning about electricity that the explorers did not have?

Fill the air piston with water to the 3.0 cc mark. Then show your air piston to your teacher. **09-Core-1C**

Box 09-Core-2 contains an air piston partly filled with a liquid. Look at the air piston, and record the volume of liquid in it. **09-Core-2C**

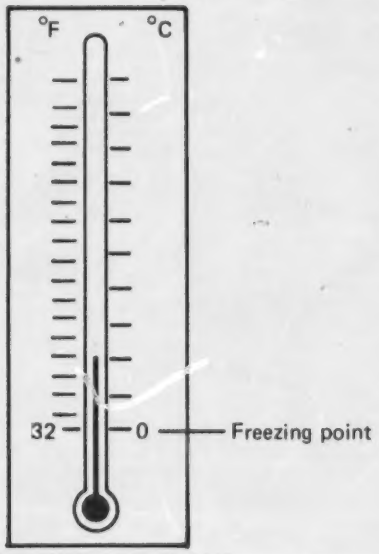
Which of the following will happen to water if you increase its temperature? **09-Core-3C**

a. Its color will change.
b. It will contract.
c. Its mass will increase.
d. Its volume will increase slightly.

A company needs to design a device which will show very tiny changes in temperature and which will have the temperature marks on the scale be rather widely spaced. Which of the following would make the best expanding substance for such a device? **09-Core-4C**

a. Alcohol
b. Water
c. A metal rod
d. Air

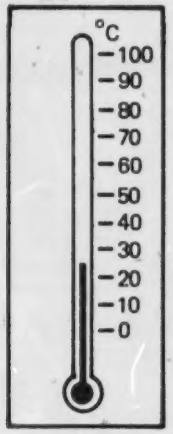
Look at the diagram below. Explain why the freezing point of water can be 32° on the Fahrenheit scale and 0° on the Celsius scale. **09-Core-5C**



Mrs. Obricki went to the store to buy a piece of cloth. She wanted 50 hands of the cloth. The clerk measured the cloth with her hand. When Mrs. Obricki measured the cloth, using her own hand, it measured only 48 hands. Feeling that she had been cheated by the clerk who measured the cloth, she went to the manager of the store and complained. What is necessary to avoid such confusion in the future? **09-Core-6C**

09-Core-7C Name the standard unit used by scientists and in ISCS for measuring temperature.

09-Core-8C If the temperature of water is lowered until it registers 0°C on the thermometer shown below, what will happen to the water? If the water temperature is raised to register 100°C, what will happen to the water?



09-Core-9C Get a beaker of water. Measure its temperature, and report the temperature to your instructor.

09-Core-10C Most thermometers are made with a liquid in a tube. Explain how such a thermometer works.

09-Core-11C Dean couldn't get the lid off a new jar of model paint. He put the top of the jar into boiling water for a few seconds and removed the lid easily. Why did heating the lid cause it to loosen?

09-Core-12C John was asked to heat a sample of liquid water for several minutes and determine the change in the heat content of the sample. He found its mass and its temperatures before and after heating. Write an operational definition for the change in the heat content.

09-Core-13C How many calories are required to raise 50 grams of water from 80°C to 100°C in three minutes?

09-Core-14C A 500 g sample of water was heated for ten minutes, and the temperature was 25°C higher than before. What would the temperature change be if a 250 g sample of water were heated under the same conditions for ten minutes?

a. 12.5°C
b. 50°C
c. 25°C
d. 75°C

What are you measuring when you use a thermometer? 09-Core-15C

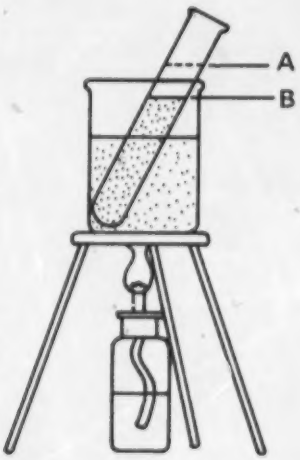
Write the letter of the choice which names a standard unit of heat. 09-Core-16C

a. temperature
b. degree
c. Celsius
d. calorie

An early model for heat assumed that heat was a substance that could flow between objects and whose quantity determined the temperature of objects. You observed some properties of heat that support the heat-substance model. What are two of them? 09-Core-17C

The diagram shows that the level of water in the test tube was at B before the test tube was heated in the beaker of water. After heating, the water in the test tube rose to level A. The heat-substance model can explain this. From the following list, select the letters of the four statements which support the heat-substance explanation of how heat gets from the burner flame into the water in the test tube. The heat substance must 09-Core-18C

a. be made up of tiny particles.
b. have mass.
c. take up space.
d. be made of a colored material.
e. be able to move.
f. be particles that move only in straight lines.
g. be a force.



An enemy agent tries to confuse you by proposing the following theory. He says that the heat-substance model is backwards, and it is really cold which is transferred, not heat. When a hot and a cold object are placed side by side, it is the cold substance which flows out of the cold object into the hot object and cools it down. The cold object gets warmer, not because it gains heat, but because it loses its cold substance. Use the activities you have done and their results to defeat this argument and keep this false theory from spreading. 09-Core-19C

09-Core-20C

The objects labeled A, B, and C are made of aluminum. Each had a mass of 100 grams. Assume that A is heated, B is cooled, and C is left at room temperature. Which of the following results would be expected immediately after treatment?

a. B will weigh more than either A or C.
b. B will weigh less than either A or C.
c. The size of B will not change.
d. A will be larger than B or C.

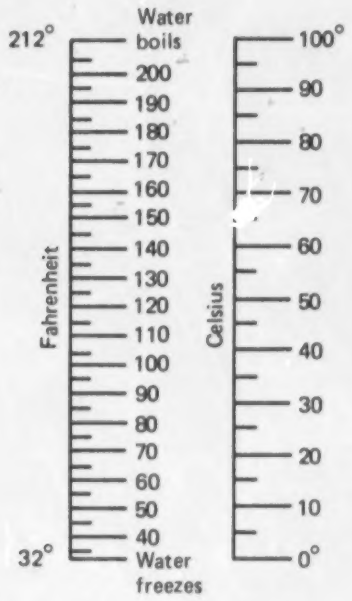
09-Exc 40-1C

Which of the following characteristics make a liquid a bad choice for a thermometer used to measure the temperature of water samples?

a. A freezing temperature lower than water's
b. A freezing temperature higher than water's
c. A boiling temperature higher than water's
d. A boiling temperature lower than water's
e. Both a and c

09-Exc 41-1C

If you hear the TV weather girl say that the temperature will drop 5° tonight, does it make any difference whether she means a temperature drop of 5° Celsius or a temperature drop of 5° Fahrenheit? Explain your answer, using information from the diagram below.



Calories are defined using water as a standard. Define *calorie* in terms of water. **09-Exc 42-1C**

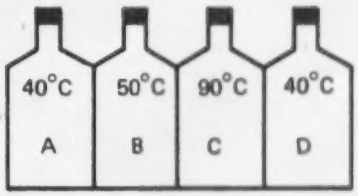
In which part of the world, the North Pole or a South Sea island, would your body need to supply more calories? Explain your answer. **09-Exc 43-1C**

In each of the following cases, 800 calories were supplied to 2000 g of the substance named. Which of them would show the greatest temperature change? **09-Exc 44-1C**

a. Oxygen, whose specific heat is 0.22
b. Helium, whose specific heat is 1.24
c. Water, whose specific heat is 1.00
d. Neon, whose specific heat is 0.25

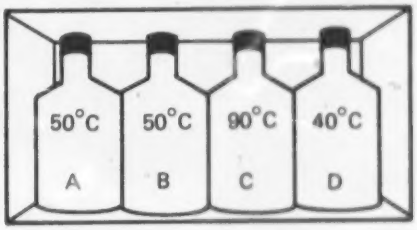
Assume that four containers of water, A, B, C, and D, are placed in contact with each other as illustrated. Select the response below which indicates the directions of heat flow that occur as the containers touch each other. Ignore the heat lost to the air. **10-Core-1C**

a. A to B, B to C, and C to D
b. A to B, B to C, and D to C
c. B to A, B to C, and C to D
d. B to A, C to B, and C to D



The four containers, A, B, C, and D, each hold the same amount of water. They are placed in contact with each other inside a box which allows no heat to escape. Approximately what will be the temperature in container B after one hour? **10-Core-2C**

a. Between 60°C and 70°C
b. More than 70°C
c. Between 55°C and 60°C
d. Less than 55°C



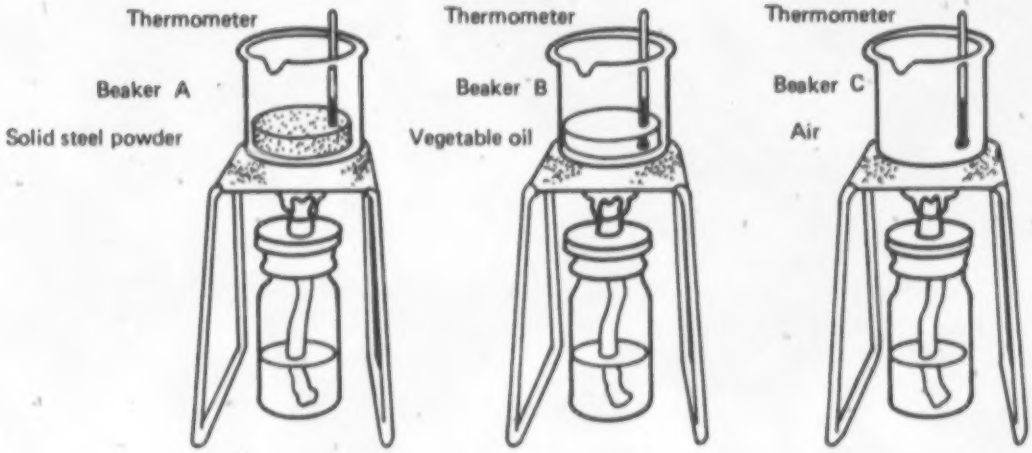
Suppose that a new substance, X, was found. If it could exist as a gas, a liquid, or a solid, in which of the following would you expect it to be the poorest conductor of heat? **10-Core-3C**

a. Solid
b. Gas
c. Liquid
d. New York
e. Either a or C

10-Core-4C

Ted put burners under all three beakers (A, B, and C) at the same time. He also put thermometers into the beakers at equal distances from the heat source, as shown.

1. In which of the beakers will the thermometer begin to show changes in temperature first?
2. Why?



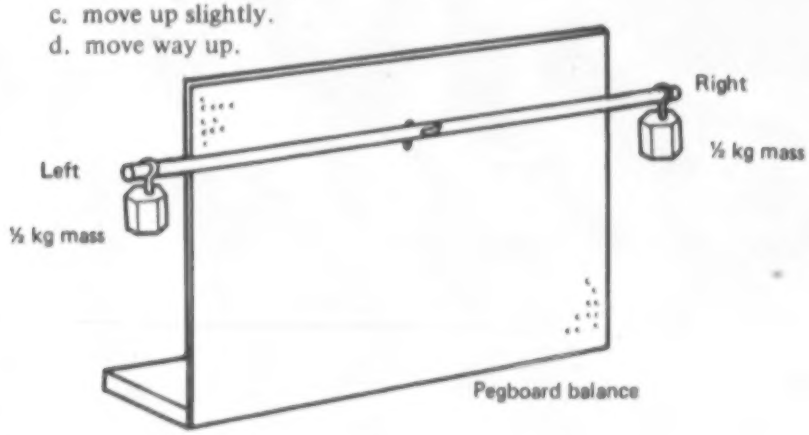
10-Core-5C

A teacher asked a team of students to criticize Activities 20-7 and 20-8. The students studied these activities. They decided that the balance was so inaccurate that if there were any small change in mass, it could not be measured. Suggest a change in the activities that would make it possible to detect small changes in mass.

10-Core-6C

Two ½ kg masses are balanced exactly on the pegboard balance as shown. Suppose the right-hand mass is heated until it gets red hot. The left-hand mass would

a. not move at all.
b. move down slightly.
c. move up slightly.
d. move way up.



Dr. I. Socket is a professor. He teaches future eye doctors a model which assumes that light travels in straight lines except when it passes from one substance to another. Dr. Jones, a university physicist, states that light is wave-like. He says that light doesn't necessarily travel in straight lines. **10-Core-7C**

Dr. Jones says, "Dr. Socket uses a model and equations that research scientists no longer use. The model does not fit all the observations made, and it does not suggest further predictions."

Dr. Socket answers, "The model I use explains all the observations included in the optics of the eye and prescriptions. Furthermore, the math involved in this theory is simple and quick. If I use the wave theory, my students and I would not be able to do the math involved without a computer."

1. Should Dr. Socket use the newer, broader model which assumes that light is a wave-like phenomenon?
2. Explain your answer.

Select the best answer. In science, models come into existence by being **10-Core-8C**

a. discovered on microscope slides.
b. found in nature by direct observation.
c. created in the minds of scientists.
d. produced as part of the data in an experiment.

Select the letter of the phrase below which completes this sentence best. Scientists use the heat-as-energy model because it **10-Core-9C**

a. provides correct answers to all questions about heat.
b. is based on the laws of nature and is therefore correct.
c. is the only model that can explain all observations about heat.
d. helps to explain observations and to predict other observations.

Scientists use the heat-as-energy model to explain heat. They use it because **10-Core-10C**

a. at least a few scientists have seen heat as energy with their own eyes.
b. heat has the exact properties of a wave.
c. they have direct proof that heat is energy.
d. thinking about heat as though it is energy explains most of the observations made to date.
e. no other model could fit the observations made to date.

10-Core-11C

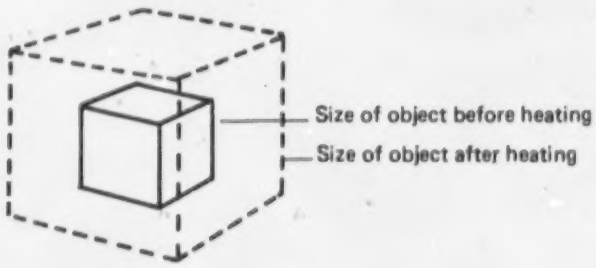
Heat-as-energy and heat-substance are two models used to explain heat. Study the chart below, and then answer the two questions that follow.

SITUATION	CAN BE EXPLAINED BY	
	Heat-as-Energy	Heat-Substance
A ring gets larger when heated.	X	X
Brass expands when heated.	X	X
Wire doesn't gain mass when heated.	X	
Spaghetti tastes better when hot than when cold.		

1. Based on the information in the chart, which is the better model?
2. Why?

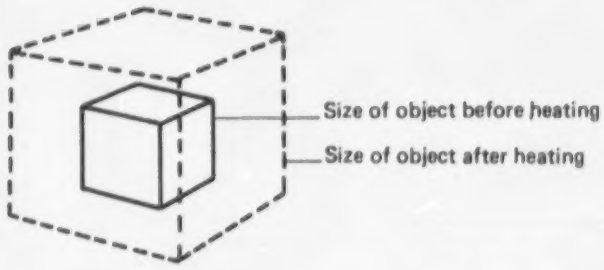
10-Core-12C

The drawing below indicates the volume of a certain object before and after heating. Using the heat-substance model, explain the increase in volume.



10-Core-13C

The drawing below indicates the volume of a certain mass of metal before and after heating. Using the heat-as-energy model, explain how the mass increased in volume.



Rub your hand rapidly in a small circle on the desk or table top. You will notice an effect on your hand. **10-Core-14C**

1. How long will this effect continue if you continue to rub the surface?
2. Explain your answer in terms of the heat-as-energy model.

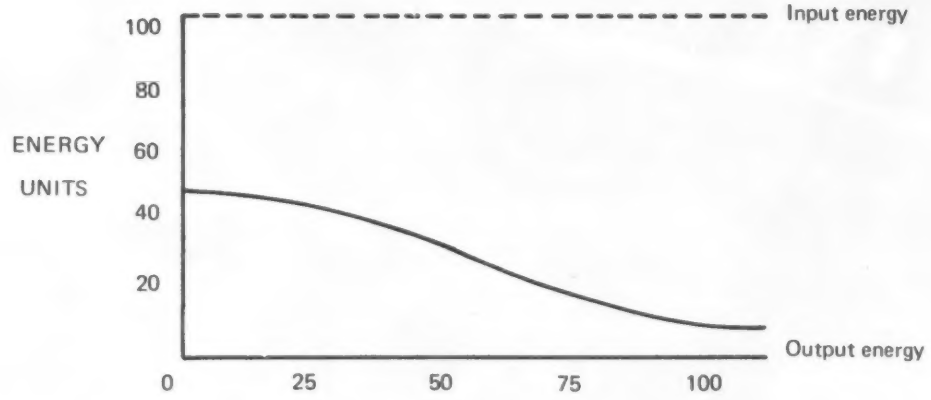
Assume that the energy within a substance called filch can be measured and that the substance can exist as a solid, a liquid, or a gas, depending on the amount of energy it possesses. Draw a line on your answer sheet like the one in the illustration below to represent the different amounts of energy. Mark the place on this line where you would expect to find each state of the filch, using S for solid, L for liquid, and G for gas. **10-Core-15C**

Low energy — High energy

The amount of heat in a can containing 5,000 ml of water at 40°C is greater than in 75 ml of water at 75°C. Use your heat-as-energy model to explain why this is true. **10-Core-16C**

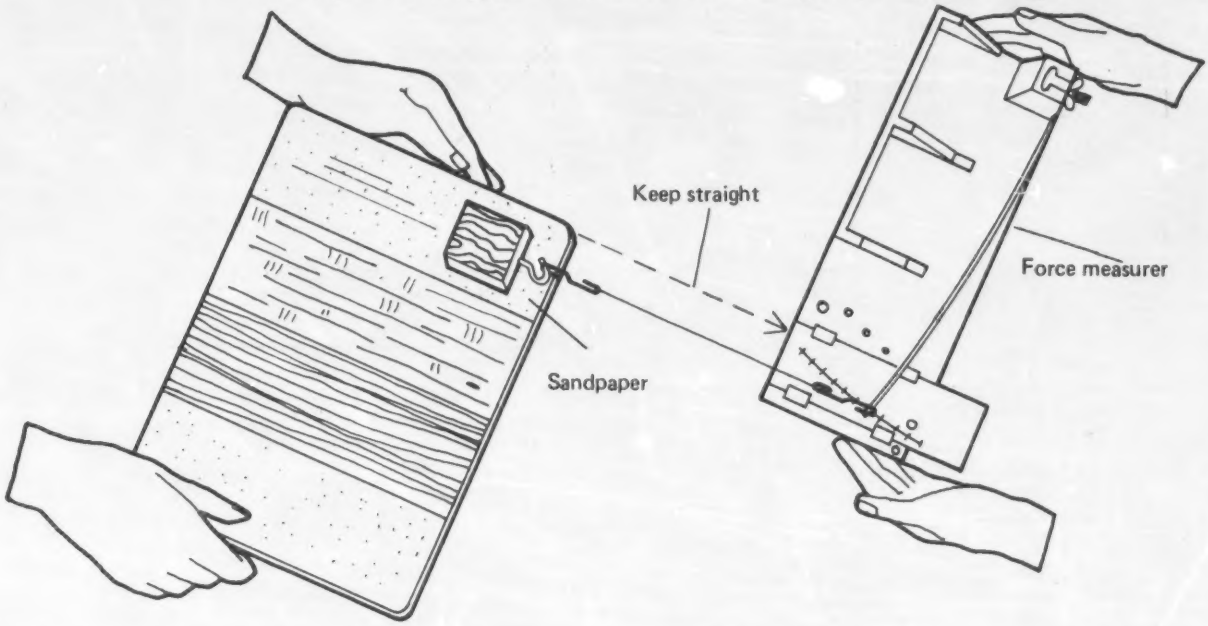
Use the heat-as-energy model to explain the movement of the liquid in the thermometer tube when it measures hot and cold materials. **10-Core-17C**

10-Core-18C



The solid line on the graph above represents the usable output energy of a model airplane engine plotted against the temperature of the engine. The amount of input energy being supplied to the engine is a constant 100 units, represented by the dotted line across the top of the graph. As the usable output energy drops, what is happening to the input energy being supplied to the engine?

10-Core-19C In the activity diagramed below, you were asked to slide the block across the sandpaper surface. The input energy it took to pull the block was greater than the amount of output energy (motion energy) produced. Use your heat-as-energy model to explain what appears to be a loss between input and output energy.

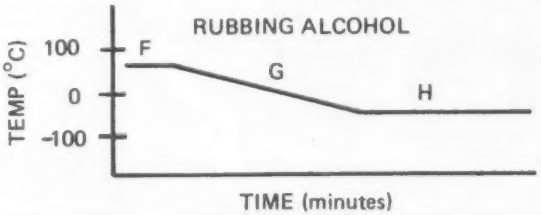


10-Exc 45-1C While on safari in Africa, a group spends one night in a cabin with bunk beds. At night it gets very cold, and a fire is kept going in the fireplace. Will those who sleep in the upper bunks be warmer than, just as warm as, or colder than those who are sleeping in the bottom bunks? Explain your answer.

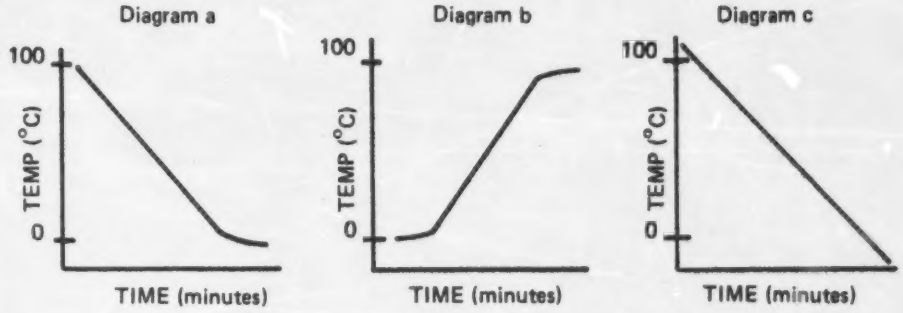
10-Exc 46-1C A scientific model is discarded when

a. new observations produce contradictions within the model.
b. an easier-to-understand model is developed which does not fit all observations.
c. a more complicated, mathematically-based model is developed.
d. the developer of the model dies.

10-Exc 47-1C Consider the cooling curve for rubbing alcohol shown on the graph below. Describe the processes that are taking place in sections F, G, and H.



Which of the time-temperature graphs shown below best describes the cooling behavior of water when it changes to ice? **10-Exc 47-2C**



The Old Mill has a water wheel which is turned by the water passing beneath it. As the wheel turns, it causes a grinding wheel to grind wheat. Has all of the kinetic energy (motion energy) of the water been converted into the mechanical energy of the grinding wheel? If not, where did the lost energy go or where did the gained energy come from? **10-Exc 48-1C**